

ภาคผนวก ง

ใบแสดงการตรวจเทียบเครื่องมือ



High Volume TSP & PM-10 Calibration Data Sheet

Calibration Location : SECOT Co.,Ltd. Calibration Date : Jan 13, 2022
 Hi-Vol Pump No. : BH-002 Indicator No. : CM-01
 Amb. Temp (°C) : 25 Press (mmHg) : 760
 Calibration by : Mr.Punkawin K.

Plate	Indicate (X) (cm.)	True H ₂ O (in.)	Actual Flow (Y) (cfm)	XY	X ²	Remark
18	16.20	11.90	57.45	930.69	262.44	
13	13.40	9.30	51.10	684.74	179.56	
10	11.00	7.40	45.72	502.92	121.00	
7	7.00	4.90	37.44	262.08	49.00	
5	4.20	3.00	29.58	124.24	17.64	
Sum	51.80	36.50	221.29	2,504.67	629.64	

Calibrated by : Punkawin Approved by : Wittayan K.



High Volume TSP & PM-10 Calibration Data Sheet

Calibration Location : SECOT Co.,Ltd. Calibration Date : Jan 13, 2022
 Hi-Vol Pump No. : BH-003 Indicator No. : CM-01
 Amb. Temp (°C) : 25 Press (mmHg) : 760
 Calibration by : Mr.Punkawin K.

Plate	Indicate (X) (cm.)	True H ₂ O (in.)	Actual Flow (Y) (cfm)	XY	X ²	Remark
18	18.20	12.30	58.38	1,062.52	331.24	
13	15.00	9.80	52.42	786.30	225.00	
10	11.80	7.50	46.02	543.04	139.24	
7	7.80	5.00	37.81	294.92	60.84	
5	4.60	3.00	29.58	136.07	21.16	
Sum	57.40	37.60	224.21	2,822.84	777.48	

Calibrated by : Punkawin Approved by : Wittayan K.



High Volume TSP & PM-10 Calibration Data Sheet

Calibration Location : SECOT Co.,Ltd. Calibration Date : Jan 13, 2022
 Hi-Vol Pump No. : BH-011 Indicator No. : CM-01
 Amb. Temp (°C) : 25 Press (mmHg) : 760
 Calibration by : Mr.Punkawin K.

Plate	Indicate (X) (cm.)	True H ₂ O (in.)	Actual Flow (Y) (cfm)	XY	X ²	Remark
18	18.00	12.80	59.53	1,071.54	324.00	
13	14.40	10.00	52.94	762.34	207.36	
10	11.60	7.80	46.90	544.04	134.56	
7	7.60	5.00	37.81	287.36	57.76	
5	4.40	3.10	30.04	132.18	19.36	
Sum	56.00	38.70	227.22	2,797.45	743.04	

Calibrated by : Punkawin Approved by : Witaya K.



High Volume TSP & PM-10 Calibration Data Sheet

Calibration Location : SECOT Co.,Ltd. Calibration Date : Jan 13, 2022
 Hi-Vol Pump No. : BH-007 Indicator No. : CM-01
 Amb. Temp (°C) : 25 Press (mmHg) : 760
 Calibration by : Mr.Punkawin K.

Plate	Indicate (X) (cm.)	True H ₂ O (in.)	Actual Flow (Y) (cfm)	XY	X ²	Remark
18	18.20	12.50	58.84	1,070.89	331.24	
13	15.00	10.00	52.94	794.10	225.00	
10	11.80	7.80	46.90	553.42	139.24	
7	7.60	5.00	37.81	287.36	57.76	
5	4.40	3.00	29.58	130.15	19.36	
Sum	57.00	38.30	226.07	2,835.92	772.60	

Calibrated by : Punkawin Approved by : Witaya K.



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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Certificate No.: CP20210095EA
Operation No.: CP2021120016

Certificate of Calibration

Equipment: Sound Calibrator

Manufacturer: RION

Model/Type: NC-74

Serial No.: 34283648

ID No.:

Customer: SECOT Co.,Ltd.

Address: 239 Rimklongprapa Rd., Bangsue,
Bangkok 10800 Thailand

Received Date: 21 December 2021

Calibrated Date: 24 December 2021

Issued Date: 28 December 2021

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

(Mr. Sittichai Swaksuriyawong)
Group Manager

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20210095EA

Calibration Report

Equipment: Sound Calibrator
Manufacturer: RION
Model/Type: NC-74
Serial No.: 34283648
ID No.:
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1010-21	13 June 2022
2) Waveform Generator	33511B	MY52302264	0144RF21	17 June 2022
3) Audio Analyzing DMM	2015-P	4079144	E1U210398	2 February 2022
4) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P210047 0255TE21	16 June 2022 7 July 2022

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Electrical and Electronics Institute; ONSC Accredited Calibration No.0119

Result of Calibration:-

1. Function : Sound pressure level

Normal	Specified Sound	Measured value	Deviated value ^[1]	Acceptance limit ^[1]
Frequency (Hz)	Pressure level (dB)	(dB)	(dB)	(dB)
1000	94	94.22	0.22	±0.25

2. Function : Frequency

Normal Sound	Specified Frequency	Measured value	Deviated value ^[2]	Acceptance limit ^[3]
Pressure level (dB)	(Hz)	(Hz)	(%)	(%)
94	1000	1003.0	0.3	±0.7



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20210095EA

Calibration Report

3. Function : Total distortion + noise

Norminal	Norminal	Measured value ^[4]	Acceptance limit ^[5]
Sound Pressure level (dB)	Frequency (Hz)	(%)	(%)
94	1000	1.3	2.5

Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.15 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	0.50 %

Note: [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
[2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
[3] The acceptance limit is for the deviated value.
[4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
[5] The acceptance limit is for the Measured value.

Remarks: 1. Using the 1/2-inch microphone adaptor NC-74-002.
2. Acceptance limit was IEC 60942:2017 Class 1.

-- End of Report --



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Certificate No.: CP20220368EA
Operation No.: CP2022120011

Certificate of Calibration

Equipment: Sound Calibrator
Manufacturer: Cirrus Research Plc
Model/Type: CR:515
Serial No.: 94296
ID No.: -
Customer: SECOT Co.,Ltd.
Address: 239 Rimklongprapa Rd., Bangsue,
Bangkok 10800 Thailand
Received Date: 14 December 2022
Calibrated Date: 20 December 2022
Issued Date: 23 December 2022
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20220368EA

Calibration Report

Equipment: Sound Calibrator
Manufacturer: Cirrus Research Plc
Model/Type: CR:515
Serial No.: 94296
ID No.: -
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1020-22	14 June 2023
2) Waveform Generator	33511B	MY52302264	CK20220058EA	19 June 2023
3) Audio Analyzing DMM	2015-P	4079144	E1U221042	16 March 2023
4) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P220024 CD20220165EA	17 March 2023 24 July 2023

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

1. Function : Sound pressure level

Norminal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value ^[1] (dB)	Acceptance limit ^[3] (dB)
1000	94	93.90	-0.10	±0.25

2. Function : Frequency

Norminal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[2] (%)	Acceptance limit ^[3] (%)
94	1000	1000.3	0.0	±0.7

Certificate No.: CP20220368EA

Calibration Report

3. Function : Total distortion + noise

Normal Sound Pressure level (dB)	Normal Frequency (Hz)	Measured value ^[4] (%)	Acceptance limit ^[5] (%)
94	1000	0.9	2.5

Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.15 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	0.50 %

- Note:
- [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
 - [2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
 - [3] The acceptance limit is for the deviated value.
 - [4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
 - [5] The acceptance limit is for the Measured value.

Remarks: 1. Acceptance limit was IEC 60942:2017 Class 1.

2. The coverage factor $k = 2.00$

-- End of Report --

Factory Calibration Certificate



Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**
 Series No **3522210172**
 Type **JT2011-E2A**

Integrity check of instrument

Appearance ✓
 Parts integrity ✓
 Screen display or touch ✓
 Instrument button ✓
 Power supply ✓
 battery ✓
 Data storage and export ✓
 Deviation degree of comparison test with
 standard instrument ✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	25.1	+0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.9	0.1	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.6	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.9	0.1	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers, Manufacturer: BGRI, Model: STA, SN: 2-56,
 Calibrated Date: 30 March 2021, Calibration Certificate No.: RA21H-AB1000009
 This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer:

Date:



Factory Calibration Certificate



Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**
 Series No **3522210173**
 Type **JT2011-E2A**

Integrity check of instrument

Appearance ✓
 Parts integrity ✓
 Screen display or touch ✓
 Instrument button ✓
 Power supply ✓
 battery ✓
 Data storage and export ✓
 Deviation degree of comparison test with
 standard instrument ✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	24.8	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	44.3	0.2	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.3	0.2	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	+0.1	0.2
GLOBE	25.0	24.9	0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.3	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers, Manufacturer: BGRI, Model: STA, SN: 2-56,
 Calibrated Date: 30 March 2021, Calibration Certificate No.: RA21H-AB1000009
 This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer:

Date:





Factory Calibration Certificate

Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**
 Series No **3522210174**
 Type **JT2011-E2A**

Integrity check of instrument

Appearance ✓
 Parts integrity ✓
 Screen display or touch ✓
 Instrument button ✓
 Power supply ✓
 battery ✓
 Data storage and export ✓
 Deviation degree of comparison test with
 standard instrument ✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	25.1	-0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers, Manufacturer: BGRI, Model: STA, SN: 2-56,
 Calibrated Date: 30 March 2021, Calibration Certificate No.: RA21H-AB1000009
 This Certificate is traceable to NCMT North China, Certificate No.: RA201-AK000073

Calibration Engineer:

Date: 2022.3.9



Factory Calibration Certificate

Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**
 Series No **3522210175**
 Type **JT2011-E2A**

Integrity check of instrument

Appearance ✓
 Parts integrity ✓
 Screen display or touch ✓
 Instrument button ✓
 Power supply ✓
 battery ✓
 Data storage and export ✓
 Deviation degree of comparison test with
 standard instrument ✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.9	0.1	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.8	0.2	0.2
GLOBE	25.0	25.1	-0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers, Manufacturer: BGRI, Model: STA, SN: 2-56,
 Calibrated Date: 30 March 2021, Calibration Certificate No.: RA21H-AB1000009
 This Certificate is traceable to NCMT North China, Certificate No.: RA201-AK000073

Calibration Engineer:

Date: 2022.3.9

Factory Calibration Certificate



Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**
 Series No **3522210176**
 Type **JT2011-E2A**

Integrity check of instrument

Appearance ✓
 Parts integrity ✓
 Screen display or touch ✓
 Instrument button ✓
 Power supply ✓
 battery ✓
 Data storage and export ✓
 Deviation degree of comparison test with
 standard instrument ✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	24.8	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.2	0.2
DRY	25.0	25.1	-0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.9	0.1	0.2
	45.0	44.8	0.2	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30%RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN: 2-56,
 Calibrated Date: 30 March 2021, Calibration Certificate No. : RA21H-AB1000009
 This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer: _____

Date: _____



Request Service No. 101/65

Page 1 of 3

Calibration Certificate

Nomenclature : Brand : Mettler Toledo Type : Top-Loading Electronic Balance
 Model : AB204-S Serial No. : 1123153292 (209359)

Submitted by : Laboratory of SECOT CO., LTD.

Location of Calibration : BAL Room , 6th Floor, Secot Co., Ltd.

Calibration range : 0 - 200 g Scale division : 0.0001 g (220 g)

Calibration date : May 26, 2022

Reference Standard No. M220177, M210183

Traceable to : Metrological Center SCI ECO Services Company Limited.

Ambient Condition : Temperature 24.80 - 25.30 °C

Humidity 54.6 - 57.5 % RH

Calibrated By : _____

(Miss Janista Kui-on)

Testing Officer

Date : 27/05/2022

Approved By : _____

(Miss Siripa Jhannong)

Chief of Technical Management

Date : 27/05/2022

Issued Date : May 27, 2022

Measurement Report

Request Service No.101/65

Page 2 of 3

Description : Brand : Mettler Toledo Type : Top-Loading Electronic Balance
Model : AB204-S Serial No. : 1123163292 (209359)
Calibration range : 0 – 200 g Scale division : 0.0001 g (220 g)
Calibration date : May 26,2022
Ambient Condition : Temperature 24.80-25.30 °C Relative humidity 54.6-57.5 % RH

Measurement data :

1. Repeatability of Reading :

Load (g)	Standard Deviation of Reading (g)	Maximum Difference between Successive Reading (g)
50	0.00008	0.0002
100	0.00010	0.0003
150	0.00010	0.0003
200	0.00012	0.0004

2. Off-Center Loading :

A Mass of 50.0000 g was placed and moved to various position on the pan.

Unit : g

Center	Front	Left	Back	Right	Center	Maximum Difference
50.00004	49.99998	50.00010	50.00008	50.00002	50.00006	0.00006

Issued Date : May 27,2022

Request Service No.101/65

Page 3 of 3

3. Departure from Nominal Value :

Reading (g)	Correction (g)	Uncertainty (+/- g)
0	0.00000	± 0.00010
1	+0.00004	± 0.00010
5	+0.00011	± 0.00010
10	-0.00002	± 0.00010
20	-0.00005	± 0.00014
40	-0.00010	± 0.00020
60	-0.00004	± 0.00014
80	-0.00012	± 0.00014
100	-0.00024	± 0.00016
120	-0.00025	± 0.00019
140	-0.00020	± 0.00022
160	-0.00022	± 0.00025
180	-0.00015	± 0.00025
200	-0.00016	± 0.00029

Calibrated by : Janyisa Kien-on

Approved By : 

(Miss Janista Kien-on)

(Miss Siripa Jhannong)

Testing Officer

Chief of Technical Management

Date : 19/05/2022

Date : 27/05/2022

Issued Date : May 27,2022



Request Service No. 001/65

Page 1 of 3

Calibration Certificate

Nomenclature : Brand : Sartorius Type : Top-Loading Electronic Balance

Model : BP 2100 Serial No. : 71003651

Submitted by : Laboratory of SECOT CO., LTD.

Location of Calibration : BAL Room , 6th Floor, Secot Co., Ltd.

Calibration range : 0 - 2000 g Scale division : 0.1 g

Calibration date : January 17, 2022

Reference Standard No. M200162 , M210183 , 21M1099

Traceable to : Metrological Center SCITECO Services Company Limited, Technology Promotion Association (Thailand-Japan)

Ambient Condition : Temperature 24.50-25.40 °C

Humidity 46.7-52.8 % RH

Calibrated By : *Khemchuda Insorn*

Approved By : *Narisa Poowasanpetch*

(Miss Khemchuda Insorn)

(Miss Narisa Poowasanpetch)

Testing Officer

Chief of Technical Management

Date : 18/01/2022

Date : 18/01/2022

Issued Date : Jan 18, 2022

Measurement Report

Request Service No. 001/65

Page 2 of 3

Description: Brand : Sartorius

Type : Top-Loading Electronic Balance

Model : BP2100

Serial No. : 71003651

Calibration range : 0 -- 2000 g

Scale division : 0.1 g

Calibration date : January 17, 2022

Ambient Condition : Temperature 24.50-25.40 °C Relative humidity 46.7-52.8 % RH

Measurement data :

1. Repeatability of Reading :

Load (g)	Standard Deviation of Reading (g)	Maximum Difference between Successive Reading (g)
500	0.063	0.20
1000	0.052	0.10
1500	0.048	0.10
2000	0.052	0.10

2. Off-Center Loading :

A Mass of 1000.00 g was placed and moved to various position on the pan.

Unit : g

Center	Front	Left	Back	Right	Center	Maximum Difference
999.58	999.58	999.62	999.58	999.56	999.56	0.050

Issued Date : Jan 18, 2022

Request Service No.001/65

Page 3 of 3

3. Departure from Nominal Value :

Reading (g)	Correction (g)	Uncertainty (+/- g)
0	0.00	± 0.07
100	0.12	± 0.07
200	0.12	± 0.07
500	0.22	± 0.07
700	0.28	± 0.07
1000	0.46	± 0.08
1200	0.48	± 0.07
1500	0.66	± 0.08
1700	0.68	± 0.07
2000	0.92	± 0.07

Calibrated by :

Khemchuda Insorn

(Miss Khemchuda Insorn)

Testing Officer

Date : 18/01/2022

Approved By :

Narisara Poowasanpetch

(Miss Narisa Poowasanpetch)

Chief of Technical Management

Date : 18/01/2022

Issued Date : Jan 18, 2022



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Pattanamontri 5 Rd., Sampran, Nakhonratchasima 30210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaicat.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com

NSC-TISI-TIS 17025
CALIBRATION 0189

CALIBRATION CERTIFICATE

Certificate No.S22051975

page 1 of 2

Customer : SECOT CO., LTD.

239 Rimklongprapa Rd.,
Bangsue, Bangkok 10800

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Sartorius

Order No. : 65S1474-1

Model : ME5

Ambient temperature : (23.0 \pm 5.0) °C

Accuracy class : -

Relative humidity : (58.0 \pm 10.0) %

Capacity : 5.1 g

Received date : 09-May-2022

Resolution : 0.000001 g

Date of calibration : 09-May-2022

Serial No. : SWB26602268

Date of issue : 10-May-2022

ID No. : -

Condition of the balance : Good working conditions

Place of calibration : BALANCE

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m ³)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2110001S	8-Oct-2022	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd. NSC-ONSC
accredited no. Calibration 0189.

Calibrated By :

*Praiwan Mungkalad*Praiwan Mungkalad
Technician

Approved By :

*Chonlatee Pongwatvisan*Chonlatee Pongwatvisan
Approved SignatoryThis calibration certificate may not be reproduced other than in full,
except with the prior written approval of the head of TCS calibration laboratory.

TCS-F-138 Issue 01/Rev.00/2 Jul 2018

NO. 19983



THAI CALIBRATION SERVICES CO., LTD.

198 Moo 9 Soi Railing 30 Pattamontorn 5 Rd., Sampran, Nakornpatom 73210

Tel: 0-3439-7682-5 Fax: 0-3439-7687

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NSG-TISI-TIS 17025
CALIBRATION 0100

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphatthasarn 5 Rd., Bangpoo, Pakkred, Nonthaburi 11120

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



NSG-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

CALIBRATION CERTIFICATE

Certificate No. SZ205197S

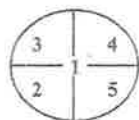
page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive reading (g)	n
5	0.000009	0.000002	5

The effect of eccentric application of a load on the indication (test load : 2 g)

Position	Balance Reading (g)
Point 1	2.000015
Point 2	2.000013
Point 3	2.000016
Point 4	2.000016
Point 5	2.000015
Eccentric Value	0.000002



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (\pm) (g)	k
Unloaded	0.000000	0.000000	0.000000	0.000027	2.65
0.001	0.001003	0.001005	-0.000002	0.000047	2.00
0.005	0.005000	0.005003	-0.000003	0.000047	2.00
0.01	0.010002	0.010005	-0.000003	0.000057	2.00
0.05	0.049998	0.049998	0.000000	0.000087	2.00
0.1	0.100005	0.100005	0.000000	0.000012	2.00
0.2	0.200007	0.200011	-0.000004	0.000014	2.00
0.5	0.499996	0.499996	0.000000	0.000018	2.00
1	1.000009	1.000007	+0.000002	0.000022	2.00
1.5	1.500005	1.500001	+0.000004	0.000039	2.00
2	2.000012	2.000015	-0.000003	0.000028	2.00
3	3.000021	3.000021	0.000000	0.000049	2.00
5	4.999989	4.999970	+0.000019	0.000035	2.00

Remark : Adjustment, Internal weights

Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor (k), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

This report will certify of the calibrated equipment only.

--End--

Certificate No. : 65-420016-1

Page : 1 of 2

Submitted by : Secot Co.,Ltd.

239 RimKlongprapa Road, Bangsue, Bangkok 10800 Thailand

Equipment : pH Meter with electrode

pH meter

Manufacturer : Mettler Toledo Model : Seven2Go S2

Range : N/A pH Resolution : 0.01 pH

Serial No. : B924795409 ID No. : N/A

Electrode

Model : InLab Expert Go-ISM Serial No. : 7861180

Environment : Ambient Temperature : (25 \pm 2) °C

Relative Humidity : (50 \pm 15) %

Date of Received : 15 February 2022

Date of Calibration : 24 February 2022

Date of Issue : 24 February 2022

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	21E997	17 Mar 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61235182	795894	14 Feb 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61223875	769927	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.008	61244986	795895	25 Feb 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F-0031-03



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphachan 3 Rd., Bangkok, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 904-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-420016-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177	0	0.58
	0.0000	7	7.00	0	0	0.58
	-177.4800	10	10.00	-177	0	0.58

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.010
	6.985	7.00	-0.01	0.011
	10.008	10.01	0.00	0.014

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%

- 300 -

3



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES

53/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250

TEL. 0-2717-2000-27 FAX. 0-2719-9184



Cert.No.: 21CH1690

Page.: 1 of 2

Certificate of Calibration

Equipment :

Conductivity Meter

Manufacturer :

Hanna

Model :

HI98192

Serial No. :

05200045101

ID No. :

-

Condition As-Received:

Used Item

Received Date :

07 December 2021

Calibration Date :

13 December 2021

Reference :

2112-0144DN-2

Submitted by :

Secot Co.,Ltd.
239 Rimklongprapa Road,
Bangsue, Bangkok 10800

Ambient Temperature :

(25 ± 2.5) °C

Relative Humidity :

(50 ± 15) %

Calibration Procedure:

In-house method :
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by :

Walelak Sirinthean

Approved by :

Walelak Sirinthean
Approved Signatory

(/) Maise Butkruea

() Saithip Meangmai

() Warakorn Lomgagtrakul

Issue Date :

15 December 2021

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 Corporate Services & Equipment Calibration and Testing Services.

A 0035796



Cert.No.: 21CH1690

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	211451	15 Apr 2022

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No, AR-1835
- Conductivity calibration solution, Thermo Scientific (traceable to NIST)

Conductivity Solution	Manufacturer	Lot No.	Exp. date
*100 μ S/cm	Thermo Scientific	101/04	12 Mar 2022
1.413 mS/cm	CPA Chem	761021	02 Aug 2022
12.8806 mS/cm	CPA Chem	754037	28 June 2022

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}$ C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1.413, 12.8806 mS/cm

Conductivity Electrode Serial No.: 0720001N

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
*100 μ S/cm	95.42 μ S/cm	99.93 μ S/cm	5.1 μ S/cm	2.00
1.413 mS/cm	1.198 mS/cm	1.412 mS/cm	0.0092 mS/cm	2.00
12.8806 mS/cm	12.49 mS/cm	12.87 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

- *: Not NSC - ONSC Accredited

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 %.

-o0o-

Maku.

a 1086390



มูลนิธิส่งเสริมศูนย์วิจัยและพัฒนา
อาหารและโภชนาการ
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2203876-002-01
Client name: SECOT CO., LTD.
Address: 239 Rimklongprapa Road,
 Bangsue, Bangsue, Bangkok 10800

Page 1 of 3

Equipment: CHAMBER (Incubator)

Manufacturer: MEMMERT

Model: ICP 400

Serial No.: K406.0004

ID No.: N/A

Order No.: 2203876

Operation No.: 2203876-002

Date of Receipt: 1 August 2022

Date of Calibration: 1 August 2022

Calibrated by Mr.Yothin Charoensuk
 Scientist

Approved by *P. Pheraphat Tuanjit*
 (Mr.Pheraphat Tuanjit) (for)
 Manager, Division of Calibration Laboratory

Date of Issue: 3 August 2022

Responsible for the Technical Management Team

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

ศูนย์วิจัยและพัฒนาอาหารและโภชนาการ
 239-ริมคลองประปา ถนนวิภาวดีรังสิต แขวงจตุจักร กรุงเทพฯ 10700
 โทร 02-5610422 โทรสาร 02-5610422 FAX 02-5610422



Calibration Report

Certificate No.: 2203876-002-01
Equipment: CHAMBER (Incubator)
Model: ICP 400 Serial No.: K406.0004
Resolution: 0.1 °C ID No.: N/A
Manufacturer: MEMMERT

Date of Calibration: 1 August 2022 Page 2 of 3

Location: Laboratory, SECOT CO., LTD.
Environment Condition: Ambient Temperature (29 ± 1) °C
Relative Humidity (66 ± 5) %
Line Voltage (220 ± 5) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 650469-01	11 June 2023	NATIONAL FOOD INSTITUTE
	RTD	CH#201-209/ RTD#201-209			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good

UUC Description :

Time of Record 1 Hour 9 Minute At 20.0 °C

Fresh air Damper
☒ Open Position ☒
☒ Close Fan ☒
☒ Not Available

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2203876-002-01
Equipment: CHAMBER (Incubator)
Model: ICP 400 Serial No.: K406.0004
Resolution: 0.1 °C ID No.: N/A
Manufacturer: MEMMERT

Date of Calibration: 1 August 2022 Page 3 of 3

Calibration point: 20.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	27.6	61	215.0
MAX	29.5	71	225.0



Table1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
20.0	20.01	20.09	20.11	20.07	20.18	20.09	20.05	19.99	20.09	0.27

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
20.0	20.0	20.0	20.0	0.10	0.10	0.37

Note: The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, 3 Aug. 2022 for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Certificate

Certificate No.: 2203876-003-01
Client name: SECOT CO., LTD.
Address: 239 Rimklongprapa Road,
 Bangsue, Bangsue, Bangkok 10600

Page 1 of 3

Equipment: Water Bath
Manufacturer: MEMMERT
Model: WB 29
Serial No.: 1698.0051
ID No.: N/A
Order No.: 2203876
Operation No.: 2203876-003
Date of Receipt: 1 August 2022
Date of Calibration: 1 August 2022

Calibrated by Mr.Yothin Charoensuk
 Scientist

Approved by


 (Mr.Pheraphat Tuanjit) (for)

Manager, Division of Calibration Laboratory
 Responsible for the Technical Management Team

Date of Issue: 3 August 2022

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2203876-003-01
Equipment: Water Bath
Model: WB 29
Resolution: 0.1 °C
Manufacturer: MEMMERT
Serial No.: 1698.0051
ID No.: N/A

Date of Calibration: 1 August 2022

Page 2 of 3

Location: Laboratory, SECOT CO., LTD.
Environment Condition:
 Ambient Temperature (29 ± 1) °C
 Relative Humidity (66 ± 5) %
 Line Voltage (224 ± 1) Volt

Condition of this results of Calibration:

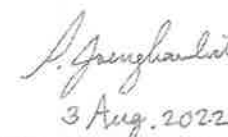
- This instrument was calibrated by insert 5 standard thermometer into its liquid bath and calibration according to W-TE-011 based on ASTM E715-80 (2016): Standard Specification for Gravity-Convection and Forced-Circulation Water Baths.
 - The temperature scale used is ITS - 90.
 - All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 650469-01	11 June 2023	NATIONAL FOOD INSTITUTE
	RTD	RTD#301-305 / CH#301-305			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good
 UUC Description:

Time of Record 1 Hour 9 Minute At 95.0 °C

7. Result of Calibration :
- | | |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | Without adjustment |
| <input type="checkbox"/> | After adjustment |


 3 Aug. 2022

F-CS-012 Revision: 01 Date: 20-04-65





MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
3110 + HGA600 + FIAS100 + AMALGAM

Page 3 of 3

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	28,2	61	223,0
Max	29,7	71	225,0



Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	
95.0	95.08	95.09	95.03	94.94	94.99	0.38

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
95.0	94.9	95.1	95.0	0.25	0.10	0.69

Note The quoted uncertainty include "Stability" and "Loading effect (20% of Temp Uniformity)"

UUC® = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

- **End**

MODEL	SERIAL NUMBER	SOFTWARE
AA-3110	311N6062102	AAWINLAB 3.2
HGA 600	2698	
AS 60	2124	
FIAS 100	1114	
AMALGAM	160S2110102	

TEST STANDARD USED	PART NUMBER
Copper	N9300183
GFAAS Mixed STD	N9300244
PE standard of Mercury	N9300174



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
3110 + HGA600 + FIAS100 + AMALGAM

SERIAL NUMBER <u>311N6062102</u>	DATE TESTED <u>June 16, 2022</u>	
1. OPTIC CHECKS		
A. Optical alignment condition (if necessary)		<input type="checkbox"/> OK
B. Condition of Mirrors, Lenses etc.		<input type="checkbox"/> OK
C. D2 and HCL beam adjust (if necessary)		<input type="checkbox"/> OK
2. ELECTRONICS CHECKS		
A. Power Supplies		
+ 5.00 Vdc \pm 0.2 Vdc	+ 5.0 Vdc	
+ 11.50 Vdc \pm 0.2 Vdc	+ 11.4 Vdc	
+ 15.00 Vdc \pm 1.0 Vdc	+ 15.2 Vdc	
- 15.00 Vdc \pm 1.0 Vdc	- 14.9 Vdc	
B. D2 Power supplies		
+150 Vdc	NA Vdc	
+ 450 Vdc	NA Vdc	
C. PMT Power supply		
- 250 Vdc	-249.0 Vdc	
3. GAS SYSTEM CHECKS		
A. Leak test all internal and external gas box joints		<input type="checkbox"/> OK
B. All gas box safety features		<input type="checkbox"/> OK
C. Burner system including nebulizer and all o-ring and gasket		<input type="checkbox"/> OK
D. Drain system		<input type="checkbox"/> OK
4. FIAS CHECK		
A. Output power supplies		
+5 VDC \pm 0.25 VDC.	5.01 VDC.	+40 VDC \pm 0.5 VDC. 40.02 VDC.
B. Valve and pump clean		<input type="checkbox"/> OK



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
3110 + HGA600 + FIAS100 + AMALGAM

SERIAL NUMBER <u>311N6062102</u>	DATE TESTED <u>June 16, 2022</u>	
5. PERFORMANCE TEST FOR FLAME		
A. Optical Filter 0.2 % Abs At 324.8 nm \pm 10 % (SPEC. = 0.1713) <u>0.174</u> Abs.		
B. Performance Tests with PE standard.		
B1. Run Std. Of <u>Cu and Cr</u> at <u>324.8 ; 357.9 nm</u> Concentration <u>4, 4</u> ppm respectively		
Results = <u>0.222, 0.228</u> Abs, with flow spoiler. respectively		
Characteristic Concentration <u>0.079 ; 0.077</u> mg/L respectively		
B2. Run Std. of <u>Pb</u> at <u>283.3 nm</u> ; Concentration <u>20</u> ppm		
Results = <u>0.1960</u> Abs, with flow spoiler.		
Characteristic Concentration <u>0.449</u> mg/L		
C. Performance Tests (For C2H2 + N2O Flame)		
Run Std. Of <u>Al</u> at <u>309.3 nm</u> ; Concentration <u>50</u> ppm		
Results = <u>0.237</u> Abs, with flow spoiler.		
Characteristic Concentration <u>0.928</u> mg/L		
6. PERFORMANCE TEST FOR FIAS		
A. Characteristic mass for Mercury		
(500 ul of 10 ug/l Hg for 0.07 Abs.)	<u>0.077</u> Abs.	
Characteristic Mass <u>314</u> pg / 0.0044 Abs.	<u>285.7</u> pg/0.0044 Abs.	
RSD \leq 2%	<u>0.62</u> %	
B. Characteristic mass for Arsenic		
(500 ul of 10 ug/l As for 0.45 Abs.)	<u>0.468</u> Abs.	
Characteristic Mass <u>48</u> pg / 0.0044 Abs.	<u>47.0</u> pg/0.0044 Abs.	
RSD \leq 2%	<u>0.83</u> %	
C. Characteristic mass for Mercury Amalgamation		
(1000 ul of 1.0 ug/l Hg for 0.03 Abs.)	<u>0.029</u> Abs.	
Characteristic Mass <u>147</u> pg / 0.0044 Abs.	<u>151.7</u> pg/0.0044 Abs.	
RSD \leq 2%	<u>1.71</u> %	



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
3110 + HGA600 + FIAS100 + AMALGAM

SERIAL NUMBER 311N6062102	DATE TESTED June 16, 2022
7. PERFORMANCE CHECK FOR FURNACE	
A. Internal & External gas flow	<input type="checkbox"/> OK
B. Contract Cylinder (replace if necessary)	<input type="checkbox"/> OK
C. Quartz Windows	<input type="checkbox"/> OK
D. Gas Tubing and Joins	<input type="checkbox"/> OK
E. Cooling System	<input type="checkbox"/> OK
8. AUTOSAMPLER CHECK	
A. Arm and gears	<input type="checkbox"/> OK
B. Sample and Rinse Pump	<input type="checkbox"/> OK
C. Tray and Sensors	<input type="checkbox"/> OK
9. PERFORMANCE TEST FOR FURNACE	ACTUAL VALUE
Test run using Chromium	
1. Standard Deviation after 5 replicates of blank ≤ 0.005	0.001
2. Characteristic mass (5 ug / L for Cr, 3 pg/0.0044 A-s)	2.8 pg / 0.0044 A-s
Peak Area	0.155 A-s
Relative Standard Deviation $\leq 2\%$	1.03 %
Test run using Lead	
Characteristic mass (20 ug / L for Pb, 10 pg/0.0044 A-s)	9.4 pg / 0.0044 A-s
Peak Area	0.188 A-s
Relative Standard Deviation $\leq 2\%$	1.24 %



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
3110 + HGA600 + FIAS100 + AMALGAM

SERIAL NUMBER 311N6062102	DATE TESTED June 16, 2022
Remarks :	
NA Mean no applicant	

This is to certify that the above tests have been performed and the configuration tested	
<input checked="" type="checkbox"/>	meets
<input type="checkbox"/>	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.	
TH ONE SOURCE CO., LTD.	
	<i>Krungchai T.</i> Krungchai Treevichien Customer Support Engineer

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.agilent.com/en-us/services/analytical-instrument-services>

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

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System Information

Instrument system name and ID	JCP 5110 VDV / HY16230003
Instrument system site and location	SECOT / 5th Fl Laboratory
List system component product numbers	List the serial numbers of each component
1. G 8015 A	1. HY16230003
2. G 8410 A	2. AU16181341
3. G 8475 A	3. HY16250001
4. G 8481	4. 3B1641345
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass other
Torch	Radial Dual View other
Injector Diameter	2.4mm 1.8mm 1.4mm 0.8mm other
Injector Material	Quartz Ceramic other



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General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. N/A
- ☒ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☐ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. N/A
- ☒ Remove and clean instrument water inlet filter.

G8481A Cooling water system

- ☐ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter.
- ☒ Re fill with Polyclear cooling fluid
- ☒ Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.



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SPS 3 Auto Sampler

- ☒ Section NOT Applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear, Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto Sampler

- ☐ Section NOT Applicable
- ☒ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☒ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☒ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☒ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☒ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

AVS 4, 6, 7

- ☒ Section NOT Applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

Instrument Adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
 - ☐ Subsystem Communications Test
 - ☒ Air Flow

**Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist**

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	8956.3	7110.7	8882.3	7221.7
Mn 257.610 nm SRBR	8019.4	24552.7	7232.9	22099.7
Al 396.152 nm SBR	9.8	22.0	9.1	20.7
K 766.491 nm SBR	4.6	63.8	4.0	55.7

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

**Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist**
ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode		Plasma On	
Mains Voltage	219.56	VAC	218.1	VAC
Mains Current	0.111	A	0.128	A
Instrument Temperature	25.7	°C	25.3	°C
RF Air Flow (sensor speed)	13.0	Hz	18.0	Hz
Plasma Exhaust Temperature	No measurement		56.4	°C
Water Flow Oscillator	No measurement		1.45	L/min
Water Flow Detector	1.28	L/min	1.24	L/min
Water Inlet Temperature	18.9	°C	20.6	°C
Polychromator Temperature	35.0	°C	35.0	°C
CCD Temperature	-39.8	°C	-33.8	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	605.60	kPa	541.94	kPa
Purge Gas Supply Pressure*1	602.97	kPa	571.75	kPa
Option Gas Supply Pressure*1	N/A	kPa	N/A	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		300.68	kPa
Plasma Gas Flow	No measurement		12.00	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1200	W
RF Supply Current	No measurement		8.213	A
RF Supply Voltage	No measurement		194.700	V

*1 If option installed

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Preventive Maintenance Checklist

ICP-OES Parts List Table

Part description	Part Number	Product / Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-G8014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-G8015	All	1
Polyclear Cooling Fluid	G3292-80010	G8481A	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 8-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80129	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☐ Complete the Service Engineer Comments section below if there are additional comments.

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- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Other Important Customer Web Links

How to get information on your product:

- ☐ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☐ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☐ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☐ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 60D4G82409 Date service completed 23 July 2021

Agilent signature Waqar T. Customer signature _____

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