



บริษัท ซีเอ็นพีซีเอชเค (ไทยแลนด์) จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม  
โครงการผลิตปิโตรเลียมแปลงสำรวจบนบกหมายเลข L21/43 ฐานหลุมผลิตบึงม่วงใต้ 1 (BMS1)  
อำเภอลานกระบือ จังหวัดกำแพงเพชร ฉบับเดือนมกราคม – ธันวาคม พ.ศ.2565

## ภาคผนวก ง.5

### เอกสารสอบเทียบเครื่องมือตรวจวัด

Support Equipment Type	: Sound Level Calibrator
Manufacture	: BSWA TECH
Model	: CAL114
Serial No.	: 590040
Range of Calibrator	
- Sound Pressure Level	: 94.1 dB.
- Frequency	: 1,000 Hz.
Calibrated By	: Mr.Apiwat Chamnanweeh
Calibration Date	: March 17, 2022
Customer Name	: Vision E. Consultants Co., Ltd. : โครงการผลิตปิโตรเลียมแปลงสัมปทานปิโตรเลียมบนบกหมายเลข L21/43 จานหลุมผลิตบึงม่วงใต้ 1 (BMS1)

[illegible]

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Approved By




Ms.Sutatip Im-noi  
Environmental Scientist



# Calibration Chart

BSWA TECH

BSWA-IV-C021-03-0048A

**Sound Calibrator model** ..... CA114  
**Serial Number** ..... 590040  
**Appearance** ..... OK  
**Power Supply** ..... 1.5V LR6 (AA battery) x2  
**Sound Pressure Level** ..... 74.06 / - dB  
**Frequency** ..... 1000.7 / - Hz  
**THD (@1000Hz)** ..... 1.03 / - %

*Copying and using select parts, or tampering with this document without the permission of BSWA is forbidden!*

**BSWA Technology Ltd.**

[www.bswa-tech.com](http://www.bswa-tech.com)

This equipment was calibrated at the following ambient conditions:

**Temperature:** ..... 20 °C  
**Humidity:** ..... 40 %RH  
**Pressure:** ..... 1025 hPa

This equipment is qualified!



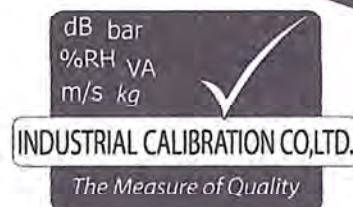
2021-5-10

**Date**

## Industrial Calibration Co., Ltd.

38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,  
Lam Luk Ka District, Phatum Thani 12130 Thailand.

Tel : +66 (02) 991 0440  
Fax : +66 (02) 531 6294  
Email : info@Industrial.co.th



CERTIFICATE No. ....CAL02055-22..... PAGE .....1..... OF .....2.....

# Certificate of Calibration

Equipment : EC/ TDS/ TEMPERATURE METER

Manufacture : HM DIGITAL

Model / Type : COM-100

Serial No. : PONPE5851384

ID No. : N/A

Customer : Environment Research & Technology Co., Ltd.

25/114 Moo 6, Soi Chinnaket 1, Ngamwongwan Road.,Tungsonghong, Laksi, Bangkok 10210

Environment: 25 +/- 3°C (IN-HOUSE); 50 +/- 20%RH

Date Of Receipt : FEB 23, 2022

Date Of Calibration : FEB 23, 2022

Calibration By : CHICHAWADEE CHANTAKHAD

Approved By :



Date of Issue : FEB 23, 2022

MEASUREMENT UNCERTAINTY :

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR  $k = 2$ , WHICH EFFECTIVE DEGREE OF FREEDOM  $V_{eff} > 100$  CORRESPONDS A LEVEL OF CONFIDENCE OF APPROXIMATELY 95 %

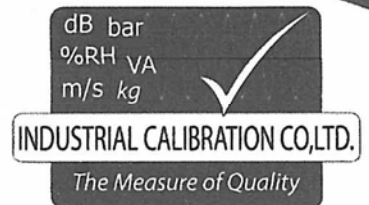
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CERTIFICATE No. ....CAL02055-22..... PAGE .....2..... OF .....2.....

## Calibration Report

ORDER No. 2009-054

RECEIVED DATE : FEB 23, 2022

CALIBRATION DATE : FEB 23, 2022

<b>DESCRIPTION:</b> EC/ TDS/ TEMPERATURE METER		<b>MANUFACTURER:</b> HM DIGITAL	
<b>MODEL:</b> COM-100	<b>SERIAL No.</b> PONPE5851384	<b>IDENTIFICATION No:</b> N/A	<b>MADE IN :</b> N/A
<b>CALIBRATION METHOD :</b> THIS INSTRUMENT WAS CALIBRATED BY COMPARISON WITH STANDARD BUFFER SOLUTION IN-HOUSE METHOD			
<b>REFERENCE STANDARD :</b>			
<b>DESCRIPTION :</b> STANDARD BUFFER SOLUTION	<b>MODEL</b> ECCON1413BT	<b>S/N No.</b> 01X211207	<b>CERTIFICATE No.</b> 060/01

### TRACEABILITY:

THE CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT: NIST  
-NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

RANGE : 1413  $\mu$ S

RESOLUTION : 1  $\mu$ S

FUNTION : CONDUCTIVITY MEASUREMENT

CALIBRATION	STANDARD	UUC*	UUC*	UNCERTAINTY
POINT	SETTING CONDUCTIVITY	READING	CORRECTION	MASUREMENT
( $\mu$ S)	( $\mu$ S)	( $\mu$ S)	( $\mu$ S)	( $\mu$ S)
1413	1413	1420	-7	12

REMARK : UUC\* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CH12

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** pH Meter  
**Manufacturer :** Eutech  
**Model :** pHTestr 30  
**Serial No. :** 3015177  
**ID No. :** NO.25  
**Condition As-Received:** Used Item  
**Received Date :** 29 December 2021  
**Calibration Date :** 05 January 2022  
**Reference :** 2112-0752WN-8  
**Submitted by :** Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
**Ambient Temperature :** (25  $\pm$  2.5) °C  
**Relative Humidity :** (50  $\pm$  15) %  
**Calibration Procedure :** In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

**Calibrated by :** Walalak Sirithean

**Approved by :**

Approved Signatory

( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lernagatrakul

**Issue Date :** 7 January 2022

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

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0036339



Cert.No.: 22CH12

Page.: 2 of 2

**Condition of this calibration result**

1. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	761016	02 Aug 2023
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	761018	02 Aug 2022

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

**Calibration Results**

**Function : pH Measurement**

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: 3015177	4.008	4.02	N/A	0.0085	2.05
	6.982	6.98	N/A	0.011	2.00
	10.015	10.02	N/A	0.0095	2.00

**Remark**

- pH meter does not have voltage mode.
- Can not connect the BNC because the plug does not match with the socket.
- N/A = Not Available

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

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*Maku*





**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
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TEL. 0-2717-3000 FAX. 0-2719-9484

**Cert.No.:** 22TW15

**Page.:** 1 of 2

## Certificate of Testing

**Equipment :** DO Meter  
**Manufacturer :** YSI  
**Model :** 5000-115V  
**Serial No. :** 03C1280 AC  
**ID No. :** ERTC-L-In-021  
**Received Date :** 19 January 2022  
**Test Date :** 21 January 2022  
**Reference :** 2201-0594WN-1  
**Submitted by :** Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
**Laboratory Condition :** Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
**Tested by :** Walalak Sirithean

**Approved by :**

Approved Signatory

( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lernagtrakul

**Issue Date :**

1 February 2022

B 0279633





Cert.No.: 22TW15

Page.: 2 of 2

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 07H100306

<b>Titration Method (Azide Modification Method) (mg/L)</b>	<b>DO Meter Reading (mg/L)</b>	<b>Standard Deviation (mg/L)</b>
8.16	8.15	0.0071

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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23-2-15

a 1091839



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Salathammasop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



## CERTIFICATE OF CALIBRATION

Certificate No. : 21-1224-004

Issue Date : 28 December 2021

Work Order No. : 21/1224

Customer Name : Environment research & Technology Co., Ltd.  
25/114 Moo6 Soi Chinaket1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210

Date of Received : 15 December 2021

Date of Calibration : 15 December 2021

Instrument Details : Description : Temperature Controlled Enclosures [Incubator]  
Manufacturer : Accuplus  
Model : Smart i250  
Serial No. : 2059-0218-0002  
ID No. : ERTC-L-IN-143  
Resolution : 0.1 °C  
Location : Laboratory

Calibration Method : This instrument was calibrated by insert standard thermometer into the chamber according to calibration procedure no. CWI-T-10 follow up to TLAS G-20-1/02-08 (E) : Guidelines for Calibration and Checks of Temperature Controlled Enclosures.

Environmental Conditions :

Temperature : Area Monitoring between 15°C to 40°C


Humidity : Area Monitoring between 30%RH to 85%RH

Line Voltage : Area Monitoring 220 VAC  $\pm$  10%

Traceability of Measurement :

This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by : Mr. Sitthisak Tonglim  
Calibration Engineer

Approved by :   
( Mr. Anuwat Yaklermjit )

Laboratory Manager

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Crystal Calibration Sales and Service Co., Ltd.

45/48 Salathammasop 31, Salathammasop Rd., Salathammasop, Thawewatthana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 <http://www.crystalcal.com> Email : info@crystalcal.com





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## CERTIFICATE OF CALIBRATION

Certificate No. : 21-1224-004

Issue Date : 28 December 2021

Work Order No. : 21/1224

### Details of Calibration

#### 1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY57006241	21-719-014	03 September 2022
Sensor type	RTD	RTD# 101-109	21-719-014	03 September 2022

2. Certificate traceable : This certificate traceable to The International System of Unit refer to Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260
3. Condition of item : Used
4. Calibration site : On - Site
5. Result of Calibration : Without adjustment
6. Evaluate Condition : Time Constant : ~ Hour 50 Minute At cal. point 20 °C  
Air vent : Off  
Fan speed status : Fixed Fan Speed
7. Calibration note : The results reported in this certificate refer to the condition of instrument on the process into the steady state of chamber
8. Sensors Installation Diagram : When ; Sensor installation location in Chamber @ Working Space  
A = Distance between sensor and wall of chamber is 5 cm
9. Dimensions of chamber : W = 0.5 m ; D = 0.5 m ; H = 0.9 m

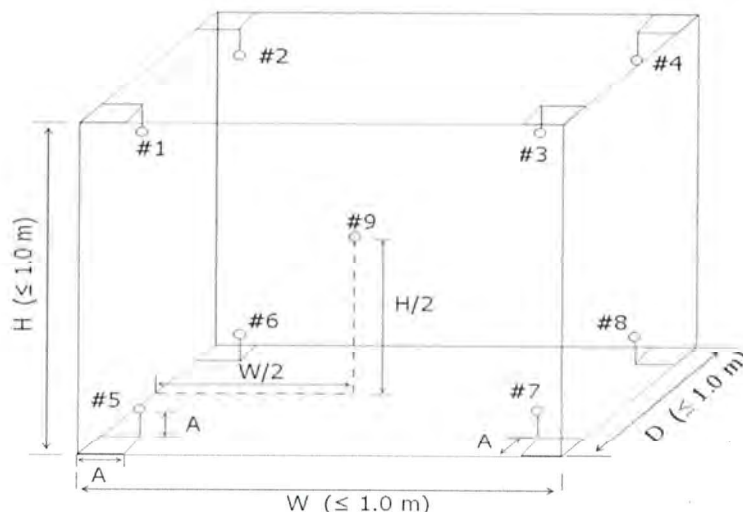


Diagram of Chamber





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## CERTIFICATE OF CALIBRATION

Certificate No. : 21-1224-004

Issue Date : 28 December 2021

Work Order No. : 21/1224

### Result of Temperature Distribution and Performance Check

Table1 : Reporting of Temperature Distribution

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.26	20.08	20.22	20.11	20.18	20.12	20.09	20.16	19.91	0.60

Table 2 : Reporting of Performance check

Indicator Set Point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
20.0	20.0	19.6	19.9	0.39	0.58	1.03

### Note

Customer would like to find internal temperature in chamber and this report customer request and accepted in certificate

The reference sensor is preferably located of the geometric center of chamber

The measured temperature data readout by software "Benchlink Datalogger 3"

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

Stability - one half of the greatest maximum difference of measured temperatures at any one sensor.

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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions.

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

Indicating Temperature - the average reading of indicating device that forms the integral part of the enclosure.

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

The 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%.





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM154

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Incubator

**Manufacturer :** Ehret

**Model :** BK 4106

**Serial No. :** 22162

**ID No. :** ERTC-L-In.-022

**Submitted by :** Environment Research & Technology Company Limited  
25/114 Moo 6 Soi Chinaket 1,  
Ngamwongwan Road, Toongsonghong, Laksi,  
Bangkok 10210

**Location :** 408/2 ห้องปฏิบัติการบ่มอาหารเลี้ยงเชื้อ

**Received Order :** 5 January 2022

**Calibration Date :** 6 January 2022

**Ambient Temperature :** (  $26 \pm 10$  ) °C

**Relative Humidity :** (  $50 \pm 30$  ) %

**Calibrated by :** Man Pattanapongpaiboon

**Approved by :**

- ( ) Pornthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :**

19 January 2022

The Uncertainties are for a confidence probability of approximately 95 %

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0036712



Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2201-0006ON-6

Cert. No.: 22TM154

Page.: 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44031769	21LM12	02 Sep 2022

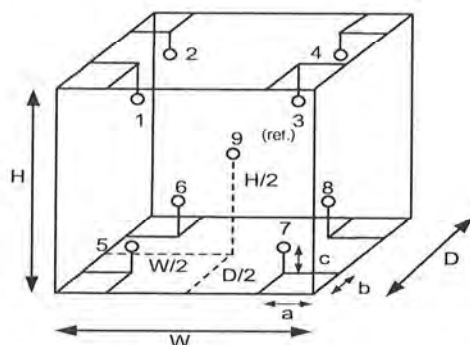
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close



Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	56	58
AC Supply ( Volt )	221	222

**Probe Installation Details :**

a = 5.0 cm  
 b = 5.0 cm  
 c = 5.0 cm

**Dimension of Chamber :**

D = 0.50 m  
 W = 0.60 m  
 H = 0.50 m  
 Capacity = 0.15 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	9RTD-2/1
2	9RTD-2/2
3	9RTD-2/3
4	9RTD-2/4
5	9RTD-2/5
6	9RTD-2/6
7	9RTD-2/7
8	9RTD-2/8
9 (ref.)	9RTD-2/9





Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2201-0006ON-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM154

Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
44.5	44.5	45.0	0.20	0.98	1.7	0.7	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
44.5	44.990	45.152	45.203	45.279	43.789	44.155	44.530	45.142	44.745

**Average\*** : The average of 30 values in each position.

**Temperature stability** : One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation** : The Difference of the maximum and minimum measured temperatures throughout observation.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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## Agilent Technologies

Agilent Technologies (Thailand) Limited  
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Email: [ccc-smt@agilent.com](mailto:ccc-smt@agilent.com)  
Website: [www.agilent.com/chem](http://www.agilent.com/chem)

### Customer Contact:

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0895030467

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Office  
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Krungthonburi Road, Banglamphu-Lang  
Klong San  
BANGKOK 10600

### Delivery Site:

Environment Research & Technology  
Co Ltd  
Head Office  
Ngamwongwan Rd  
25/114 Moo 6 Soi Chinnakhet 1

### Location:

Room  
Bldg  
Lab  
Dept

## SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70472666
Service Request:	Service Request Date:
Service Order: 6004983683	Service Confirmation: 6903908836

### Direct Inquiries to:

Contact Name:	Customer Contact Center
Contact E-mail:	<a href="mailto:ccc-smt@agilent.com">ccc-smt@agilent.com</a>
Contact Telephone:	+662 637 6363
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Sub-district, Wattana District, Bangkok 10110 Thailand  
Acc. No: 012-4452-007 ,  
THB:Krung Thai Bank PCL  
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330  
Thailand

ORIGINAL



Service Confirmation Number: 6903908836

Service Confirmation Date: 18.11.2021

**Service Instrument:**

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IO-5100	ICP-OES 5100/5110 System			
G8481A	Water chiller	1A1560387		SYS-IO-5100
G8011A	Agilent 5100 VDV ICP-OES Spectrometer	MY15330001		SYS-IO-5100
G8410A	SPS 4 Autosampler	AU15220240		SYS-IO-5100

**Service Items:**



Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
2000	PM	Preventive Maintenance	1.00	Agreement Entitlement - 100 % covered	18.11.2021	18.11.2021
2040	G8010-68015	Spare pre-optic window rad,5100 ICP 1/pk	1.00	Agreement Entitlement - 100 % covered		
2030	G8010-68014	Spare pre-optic window ax,5100 ICP 1/pk	1.00	Agreement Entitlement - 100 % covered		
2020	G8010-60136	Filter Argon ICP-OES 5100 Series	1.00	Agreement Entitlement - 100 % covered		
2010	G8000-68002	Inlet cooling air filter for MP-AES	1.00	Agreement Entitlement - 100 % covered		

**Additional Information:**

Service Confirmation Number: 6903908836

Service Confirmation Date: 18.11.2021

**Service Information:**

<b>Problem Description:</b> T-WM-S-PMOQ-IO5100-5000961745		
<b>Service Provided:</b> Discuss any issues with the customer prior to starting/ perform to preventive maintenance checklist and replace parts		
<b>Service Overview Code:</b> Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
<b>Reported Hours:</b> 4.0	<b>Travel Hours:</b> 2.0	
<b>Customer Field Service Representative Name:</b> Piyawit Sompanithan	<b>Customer Field Service Representative Signature:</b> 	<b>Date:</b> 18 Nov 2021
<b>Customer Name:</b> RAIWIN POSIT	<b>Customer Signature:</b> 	<b>Date:</b> 18 Nov 2021
<b>Additional Comments:</b>		



Agilent CrossLab Compliance Services

Agilent  
**CrossLab**  
From Insight to Outcome

## EQUIPMENT QUALIFICATION REPORT (EQR)

### Agilent CrossLab Compliance

Qualification Type:	ES-OQ
System ID:	MY15330001
EQP Name:	AgilentRecommended
EQP Revision:	ES.02.50
EQP Publish Date:	March 2020
Date:	November 29, 2021 3:20:41 PM
Report Type:	Report
Org. Name:	Environment Research & Technology Co., Ltd
Org. Location:	25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd., Bangkok 10210

# Table of Contents

Section	Page
Cover page	1
Table of Contents	2
Test Summary	3
Service Details	4
Instrument Details	5
Protocol Details	6
Tests	7
Preparation : 5100 VDV	7
Instrument Tests : 5100 VDV	10
Autosampler Operation : Autosampler 1 - SPS4	11
Declaration of Change Control	12
Attachments	13
Signature	29
Transaction Logs	30



# Test Summary

## Purpose

This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

## Details

Test	Status	Runs
Preparation : 5100 VDV	Pass	1
Instrument Tests : 5100 VDV	Pass	1
Autosampler Operation : Autosampler 1 - SPS4	Pass	1

## Overall Qualification Status

Pass



## Service Details

### Purpose

This section includes local contact and delivery details for this service.

### General Details

Service Order No./Request:	6004983683
EQP Name:	AgilentRecommended
EQP Revision:	ES.02.50
Report Type:	Report

### Organization Details

Name:	Environment Research & Technology Co., Ltd
Location:	25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd., Bangkok 10210

### Local Contact Details

Name:	Khun Raiwin Posit
Job Title:	Supervisor Scientist
Qualification Location:	ICPOES Room

### Operator Details

Name:	Kanyakorn Sukpathrajarearn
Job Title:	Field Service Engineer

### Data Acquisition Details

Acquisition Software Name:	ICP Expert
Acquisition Software Revision:	7.1.0.6821

Customer Data System (CDS):	Es: ICP Expert
-----------------------------	----------------

# Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

### Spectrometer 1

Manufacturer	Agilent Technologies
Name	5100 VDV
Model Number	G8011A
Sample Introduction	Double pass glass cyclonic spraychamber and seaspray nebulizer
Serial Number	MY15330001
Firmware Revision	2994

### Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G8481A
Serial Number	1A1560387

### Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU15220240



# Protocol Details

## Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ES.02.50	Autosampler Operation
ES.02.50	Instrument Tests
ES.02.50	Preparation

# Preparation

## Purpose

This test records a status for each preparation task for the Agilent ICP-OES.

## Configuration Details

Model/Serial No.:	G8011A	MY15330001
-------------------	--------	------------

## Results

Criteria	Observed Result	Expected Result	Status
Does the plasma ignite successfully in the first three attempts?	Yes	Yes	Pass
Was the detector calibration performed and completed successfully?	Yes	Yes	Pass
Was the instrument calibration performed and completed successfully?	Yes	Yes	Pass



Test Evidence

Image Details:

Was the detector calibration performed and completed successfully?

Date and Time:

November 29, 2021 3:09:22 PM

Host Name:

5CG9231J5L

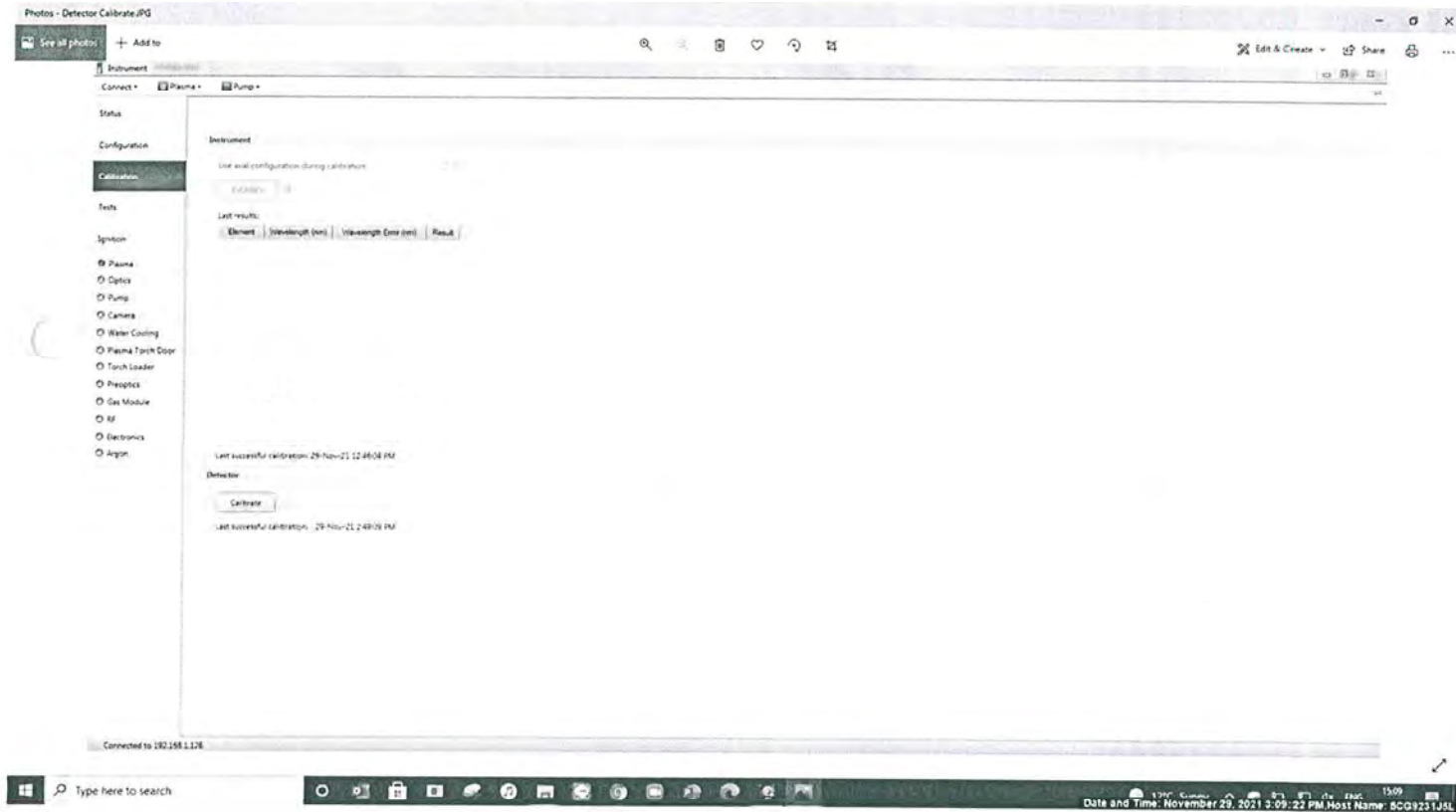




Image Details:

Was the instrument calibration performed and completed successfully?

Date and Time:

November 29, 2021 3:09:37 PM

Host Name:

5CG9231J5L

Photos - Axial View Calibration.JPG

See all photos + Add file

Instrument

Connect Plasma Pump

Status

Configuration

Calibration

Tests

Ignition

Plasma

Cytops

Pump

Camera

Water Cooling

Plasma Torch Door

Torch Loader

Prescripts

Gas Module

RF

Electronics

Argon

Instrument

Use axial configuration during calibration

Calibrate

Last results:

Element	Wavelength (nm)	Wavelength Error (nm)	Result
Ar	167.018	0.000990	✓
N	174.213	0.000640	✓
Ar	188.301	-0.000751	✓
C	193.027	-0.000098	✓
Ar	193.496	-0.000090	✓
Se	196.026	-0.001167	✓
Mo	202.032	0.000725	✓
Zn	202.545	-0.001789	✓
Mo	203.646	0.000154	✓
Mo	204.555	0.001152	✓
Cr	205.56	-0.001520	✓
Cr	213.287	-0.003317	✓
Cr	214.439	-0.003829	✓
Pb	220.283	-0.003824	✓

Last successful calibration: 29-Nov-21 3:10:08 PM

Detector

Last successful calibration: 29-Nov-21 2:49:09 PM

Connected to 192.168.1.128

Type here to search

15:09

Date and Time: November 29, 2021 3:09:37 PM Host Name: 5CG9231J5L

Overall Test Status

Pass

Runs: 1

# Instrument Tests

## Purpose

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

## Configuration Details

Model/Serial No.:	G8011A	MY15330001
-------------------	--------	------------

Results	Observed Result	Expected Result	Status
Are the Functional Tests results within acceptance criteria?			
Subsystem Communications	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
Air Flow	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
Water Flow	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
Gas Flows	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
RF Generator	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
Camera	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
Optics	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>

Are the Instrument Performance Tests results within acceptance criteria?

Resolution	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
Sensitivity	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>
Precision	<div>Yes</div>	<div>Yes</div>	<div>Pass</div>

## Overall Test Status

Pass	Runs: 1
------	---------

# Autosampler Operation

## Purpose

This test verifies that the autosampler operates properly.

## Configuration Details

Model/Serial No.:	G8410A	AU15220240
-------------------	--------	------------

## Results

Criteria	Observed Result	Expected Result	Status
Does the autosampler successfully move to the specified location(s)?	Yes	Yes	Pass

## Overall Test Status

Pass	Runs: 1
------	---------





## Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

## Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.

Location	Category	Document Name	Page
EQR	General	Certificate of Qualification for ACE	14
EQR	General	Certificate of Qualification for ACE	15
EQR	General	Operator's training certificate and qualifications	16
EQR	General	Certificate of Qualification for ACE	17
EQR	Material	Certificate of Analysis Wavelength calibration solution	18
EQR	General	Instrument's Test Report	22
EQR	General	Instrument's Test Report	25
EQR	General	Instrument's Test Report	26
EQR	General	Instrument's Test Report	27
EQR	General	Instrument's Test Report	28

General

Document Name:

Certificate of Qualification for ACE



Agilent Compliance Engine Self Qualification

Date:November 29, 2021 3:10:26 PM

Drive Serial #:EAF04572Platform Revision:ACE 3.11

Individual self-qualification reports for each specific technique installed are also available upon request. They provide additional details on the general report from the concise summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Emission Spectroscopy	3	Conforms
Software	6	Conforms

Overall Qualification Status

Conforms



## General

Document Name: Certificate of Qualification for ACE



## Certificate of Completion

Learner Name: Kanyakorn Sukpathrajareon

Title Of Course: AN-CE-SS-II-030-A: ACE 3.X User Update Training

Completion Date: June 25, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

## General

Document Name: Operator's training certificate and qualifications



## Certificate of Completion

Learner Name: Kanyakorn Sukpathrajarearn

Title Of Course: ANV-CE-ICPOES-2-008-A: Agilent 5100 ICP-OES Support Neophyte Training

Completion Date: November 2, 2017

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

General

Document Name:	Certificate of Qualification for ACE
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## Certificate of Completion

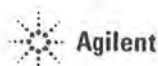
Learner Name:	Kanyakorn Sukpathrajareon
Title Of Course:	ANV-CE-ICPOES-2-007-C: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-OES Systems
Completion Date:	October 30, 2020
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

## Materials

Document Name: Certificate of Analysis Wavelength calibration solution



## CERTIFICATE OF ANALYSIS

**Agilent Product Name:** Wavelength Calibration Solution for ICP-OES & MP-AES, 5 mg/L, 500mL

**Agilent Part No:** 6610030100

**Lot No:** 0010888002

### Product Specifications

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO <sub>3</sub> ) <sub>3</sub>	7784-27-2	5.000 ± 0.025 mg/L	Mn	Mn	7439-96-5	5.003 ± 0.025 mg/L
As	As	7440-38-2	5.002 ± 0.025 mg/L	Mo	(NH <sub>4</sub> ) <sub>2</sub> MoO <sub>4</sub>	13106-76-8	5.001 ± 0.025 mg/L
Ba	Ba(NO <sub>3</sub> ) <sub>2</sub>	10022-31-8	4.999 ± 0.025 mg/L	Ni	Ni	7440-02-0	5.001 ± 0.025 mg/L
Cd	Cd	7440-43-9	5.002 ± 0.025 mg/L	Pb	Pb	7439-92-1	4.998 ± 0.025 mg/L
Co	Co	7440-48-4	5.000 ± 0.025 mg/L	Se	Se	7782-49-2	5.003 ± 0.025 mg/L
Cr	Cr(NO <sub>3</sub> ) <sub>3</sub>	13548-38-4	5.001 ± 0.025 mg/L	Sr	Sr(NO <sub>3</sub> ) <sub>2</sub>	10042-76-9	5.001 ± 0.025 mg/L
Cu	Cu	7440-50-8	5.003 ± 0.025 mg/L	Zn	Zn	7440-66-6	5.002 ± 0.025 mg/L
K	KNO <sub>3</sub>	7757-19-1	50.00 ± 0.25 mg/L				

**Matrix:** 5% HNO<sub>3</sub>

**Intended Use:** This solution is intended for use as a certified reference material or calibration standard for inductively coupled plasma optical emission spectroscopy (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), atomic absorption spectroscopy (flame AAS or GFAAS), microwave plasma atomic emission spectroscopy (MP-AES), x-ray fluorescence spectroscopy (XRF), and other techniques for elemental analysis.

**Certification & Traceability:** This CRM was manufactured under a quality management system that is registered to ISO 9001, ISO 17034 and ISO/IEC 17025. This CRM was prepared to the certified concentrations shown above by gravimetric methods using single-element concentrates that were certified using the "High Performance ICP-OES" protocol developed by NIST and are directly traceable to the NIST SRMs listed below. This solution was stabilized using high purity nitric acid (HNO<sub>3</sub>) and diluted with filtered (0.22µm), 18 M-ohm deionized water. The balances used in the preparation of this CRM are calibrated regularly with traceability to NIST. All volumetric dilutions are performed in Class A calibrated glassware. The certified concentrations were determined based upon gravimetric procedures. Secondary verification of the certified concentrations was performed using ICP-OES that was calibrated and/or referenced against NIST SRMs, 3101a, 3103a, 3104a, 3108, 3113, 3112a, 3114, 3141a, 3132, 3134, 3136, 3128, 3149, 3153a, and 3168a. The uncertainty associated with each certified concentration represents the expanded uncertainty at the 95% confidence level using a coverage factor of k=2.

**Instructions for Use:** Agilent recommends that the solution be thoroughly mixed by repeated shaking or swirling of the bottle immediately prior to use. To achieve the highest accuracy the analyst should: (1) use only pre-cleaned containers and transferware, (2) avoid pipetting directly from the CRM's original container, (3) use a minimum sub-sample size of 500µL, (4) make dilutions using calibrated balances or certified volumetric class A flasks and pipettes, (5) dilute to volume using the same matrix as the original CRM, and (6) never pour used product back into the original container. The solution should be kept tightly capped and stored under normal laboratory conditions. Do not freeze, heat, or expose to direct sunlight. Minimize exposure to moisture or high humidity.



Document Name: Certificate of Analysis Wavelength calibration solution



**Period of Validity:** Agilent ensures the accuracy of this solution until the expiration date shown below, provided the instructions for use are followed. During the period of validity, the purchaser will be notified if this product is recalled due to any significant changes in the stability of the solution.

Date of release: 17 October 2020  
Date of expiration: 17 April 2022

Sample lot approver:

A handwritten signature in cursive script that reads "Chuck Goudreau".

Chuck Goudreau, Certifying Officer

Page 2 of 3

Document Name: Certificate of Analysis Wavelength calibration solution



**Hazard Information:** Refer to the Safety Data Sheet (SDS), which can be obtained at [www.agilent.com/chem/sds](http://www.agilent.com/chem/sds).

**Homogeneity:** This solution was determined to be homogeneous by procedures consistent with the requirements of ISO 17034 and ISO Guide 35. Replicate samples of the finished solution were analyzed to confirm its homogeneity, in accordance with QSP 6-13 Assessment of Homogeneity and Stability. To ensure homogeneity, users should not take a smaller sub-sample than specified in the Instructions for Use, as doing so will invalidate the certified values and uncertainties.

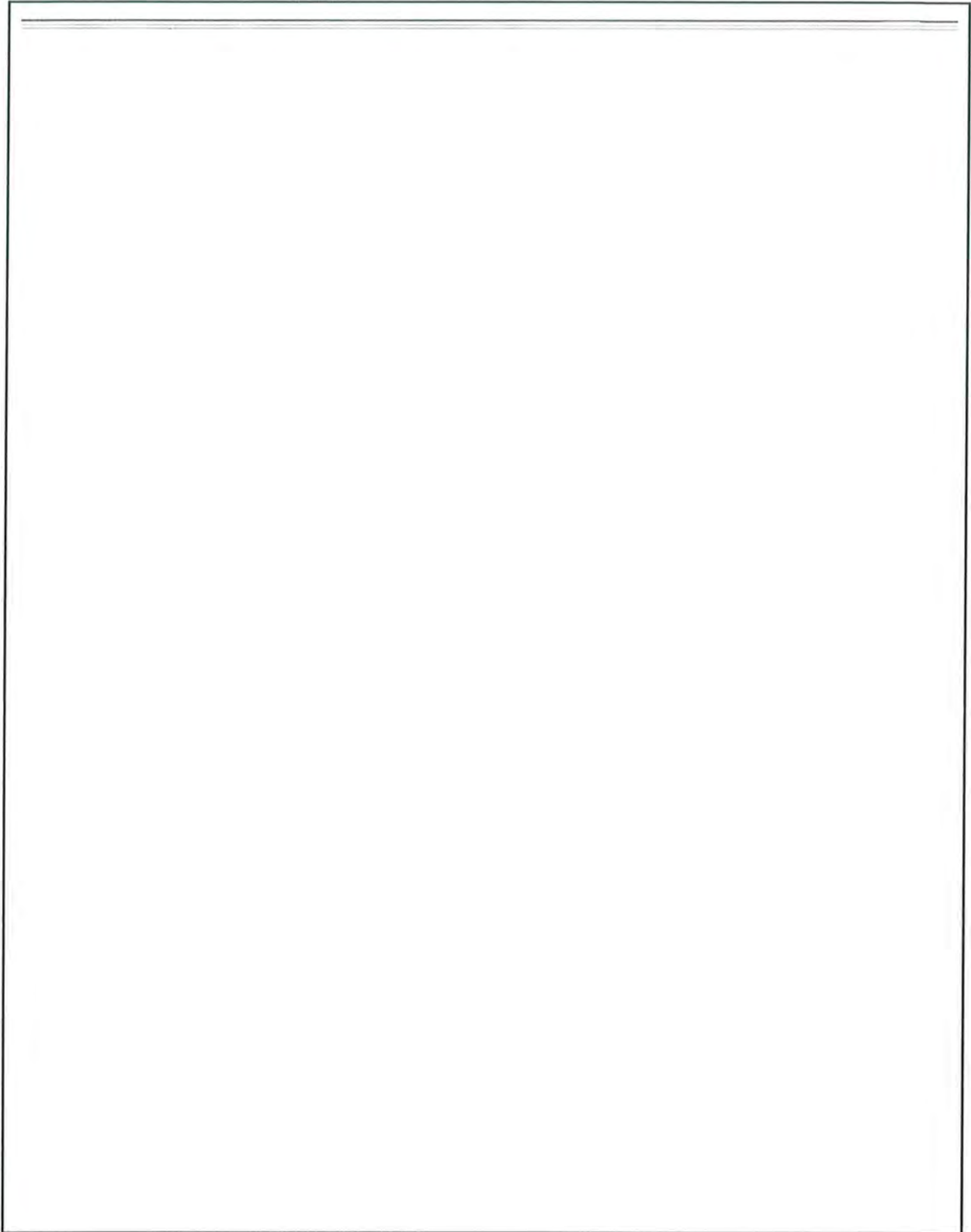
**Further Information:** Please contact Agilent for further information about this CRM.

**Quality Certifications:** This CRM was prepared under a quality management system that is:

- Registered to ISO 9001 – Quality Management Systems – Requirements (TUV NORD Cert. Reg. No. 44 100 16560231)
- Accredited to ISO 17034 – General Requirements for the Competence of Reference Material Producers (A2LA Cert. No. 2848.02)
  - ISO 17034 references additional requirements specified in ISO Guide 31 and ISO Guide 35.
- Accredited to ISO/IEC 17025 – General Requirements for the Competence of Testing and Calibration Laboratories (A2LA Cert. No. 2848.01)
- LDC Standards, 276 Abby Road, Manchester, NH 03103

Document Name:

Certificate of Analysis Wavelength calibration solution



## General

Document Name: Instrument's Test Report

## Report Summary

Instrument Model	Agilent 5100 VDV ICP-OES
Instrument ID	G8011A
Instrument Serial Number	MY15330001
Software Version	7.1.0.6821
Firmware Version	2994
Tested By	Kanyakorn S.
Test Completed On	29-Nov-21 3:18:24 PM

## Result Summary

Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

## Resolution Test

Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.54
As (188.980 nm)	≤ 8.20	6.72
C (193.027 nm)	≤ 11.50	8.01
Mo (202.032 nm)	≤ 8.20	6.80
Cr (206.158 nm)	≤ 13.40	10.24
Zn (213.857 nm)	≤ 8.70	7.54
Pb (220.353 nm)	≤ 9.50	7.71
Co (228.615 nm)	≤ 17.20	11.30
Ba (230.424 nm)	≤ 9.40	8.19
Mn (257.610 nm)	≤ 13.30	9.60
Mn (260.568 nm)	≤ 20.30	16.52
Cr (267.716 nm)	≤ 11.00	9.08
Cu (324.754 nm)	≤ 25.00	18.23
Cu (327.395 nm)	≤ 14.20	12.53
Sr (338.071 nm)	≤ 33.50	27.38
Ba (455.403 nm)	≤ 44.00	34.14
Sr (460.733 nm)	≤ 36.00	21.93
Ba (493.408 nm)	≤ 36.00	29.13
Ba (614.171 nm)	≤ 42.00	27.47
Ar (675.283 nm)	≤ 74.00	67.94
K (766.491 nm)	≤ 80.00	63.70

Page 1 of 3



Document Name:

Instrument's Test Report

Sensitivity Test			Pass		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	122.4	1199.1	83.2
Se (196.026 nm)	≥ 41.0	SRBR	79.1	935.2	109.1
Zn (213.857 nm)	≥ 1421.0	SRBR	3206.2	52338.5	263.8
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2838.4	233.0
Mn (257.610 nm)	≥ 3518.0	SRBR	10484.0	285474.0	737.6
Al (396.152 nm)	≥ 3.4	SBR	5.7	37125.2	5560.4
Ba (493.408 nm)	≥ 34.0	SBR	84.3	1024562.6	12016.8
K (766.491 nm)	≥ 1.8	SBR	3.9	104539.1	21328.3
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	276.1	4320.0	220.4
Se (196.026 nm)	≥ 159.0	SRBR	179.5	3290.1	281.0
Zn (206.200 nm)	≥ 234.0	SRBR	1432.3	22017.4	231.4
Zn (213.857 nm)	≥ 1743.0	SRBR	6972.3	204965.9	857.0
Cd (214.439 nm)	≥ 4227.0	SRBR	7810.0	163528.6	436.1
Pb (220.353 nm)	≥ 320.0	SRBR	600.5	16920.2	727.3
Mn (257.610 nm)	≥ 10625.0	SRBR	31358.8	1574284.8	2512.2
Cr (267.716 nm)	≥ 1048.0	SRBR	4587.3	186346.2	1621.6
Cu (324.754 nm)	≥ 19.0	SBR	51.8	253941.6	4813.6
Al (396.152 nm)	≥ 6.0	SBR	12.4	263070.7	19621.4
Ba (493.408 nm)	≥ 60.0	SBR	190.6	6858283.6	35799.9
K (766.491 nm)	≥ 24.0	SBR	63.4	3363913.7	52206.8

Page 2 of 3

Document Name:

Instrument's Test Report

## Precision Test

Pass

## Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 2.60$	1.19
Se (196.026 nm)	$\leq 2.60$	1.14
Zn (213.857 nm)	$\leq 1.50$	0.47
Pb (220.353 nm)	$\leq 2.60$	0.84
Mn (257.610 nm)	$\leq 1.50$	0.42
Al (396.152 nm)	$\leq 1.50$	0.37
Ba (493.408 nm)	$\leq 1.50$	0.77
K (766.491 nm)	$\leq 1.50$	0.29

## Axial

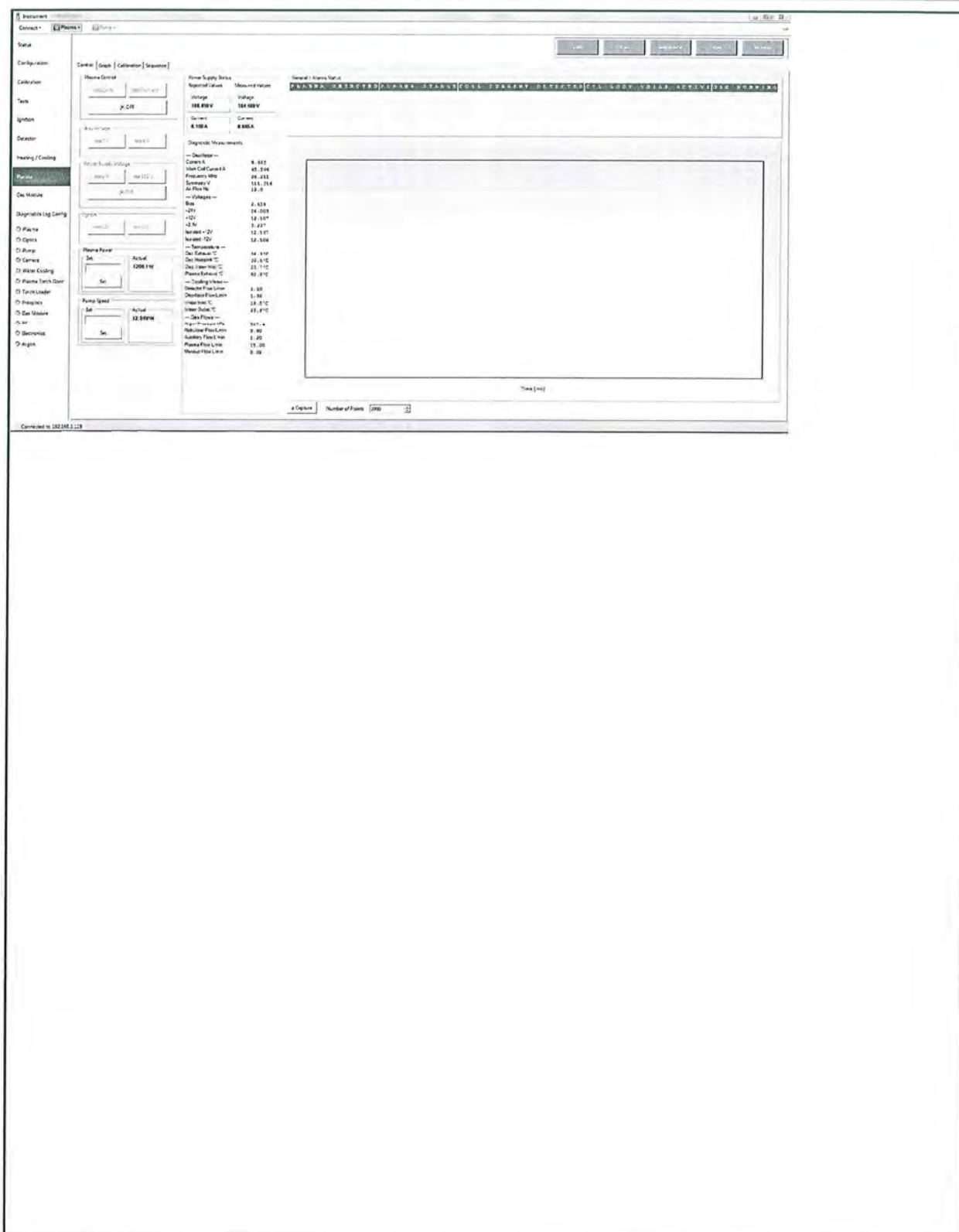
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 1.50$	0.68
Se (196.026 nm)	$\leq 1.50$	0.64
Zn (206.200 nm)	$\leq 1.50$	0.29
Zn (213.857 nm)	$\leq 1.50$	0.37
Cd (214.439 nm)	$\leq 1.50$	0.34
Pb (220.353 nm)	$\leq 1.50$	0.33
Mn (257.610 nm)	$\leq 1.50$	0.74
Cr (267.716 nm)	$\leq 1.50$	0.29
Cu (324.754 nm)	$\leq 1.50$	0.37
Al (396.152 nm)	$\leq 1.50$	0.35
Ba (493.408 nm)	$\leq 1.50$	0.55
K (766.491 nm)	$\leq 1.50$	0.60

Page 3 of 3

## General

Document Name:

Instrument's Test Report

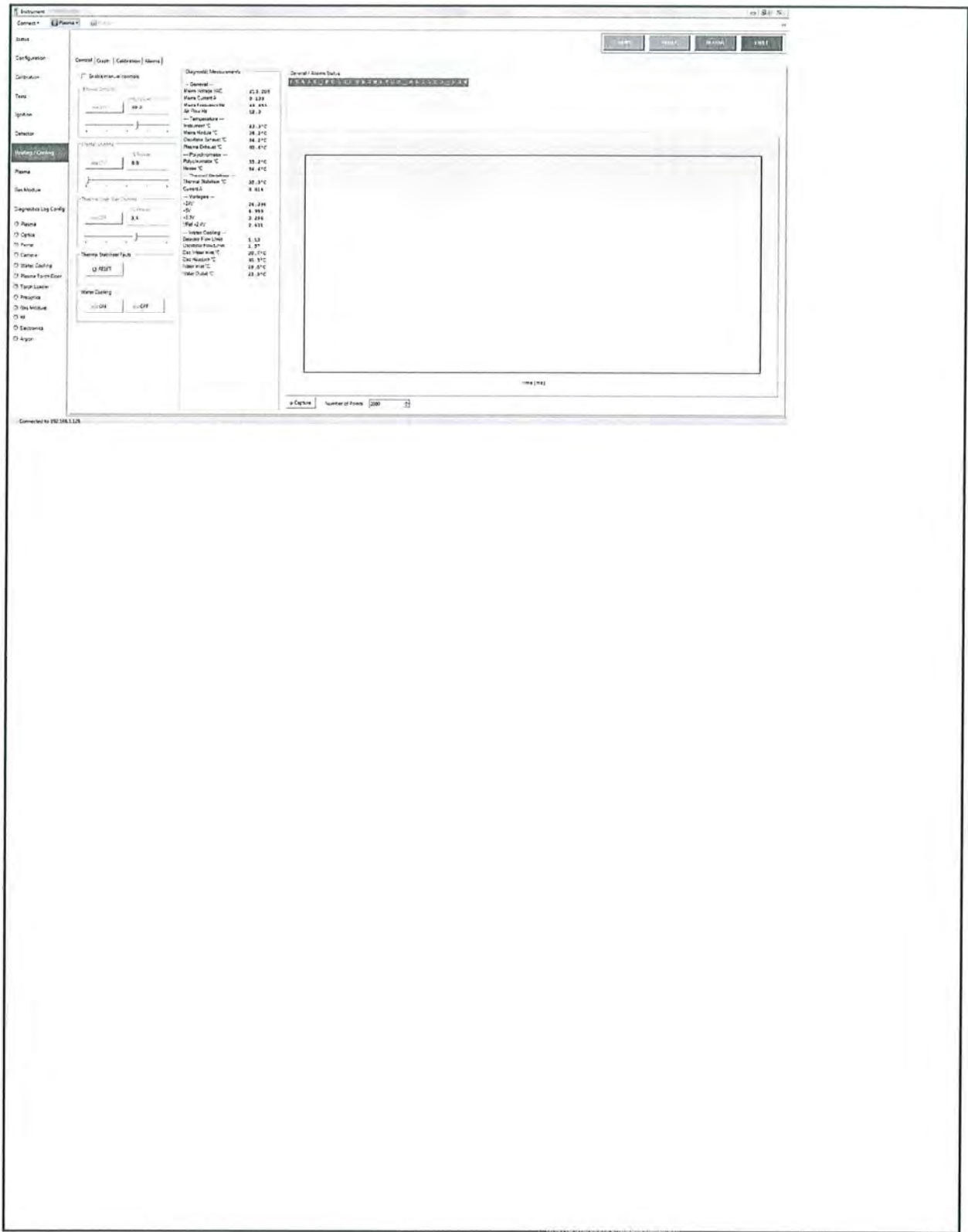


Date: November 29, 2021 3:20:41 PM  
System ID: MY15330001

General

Document Name:

Instrument's Test Report

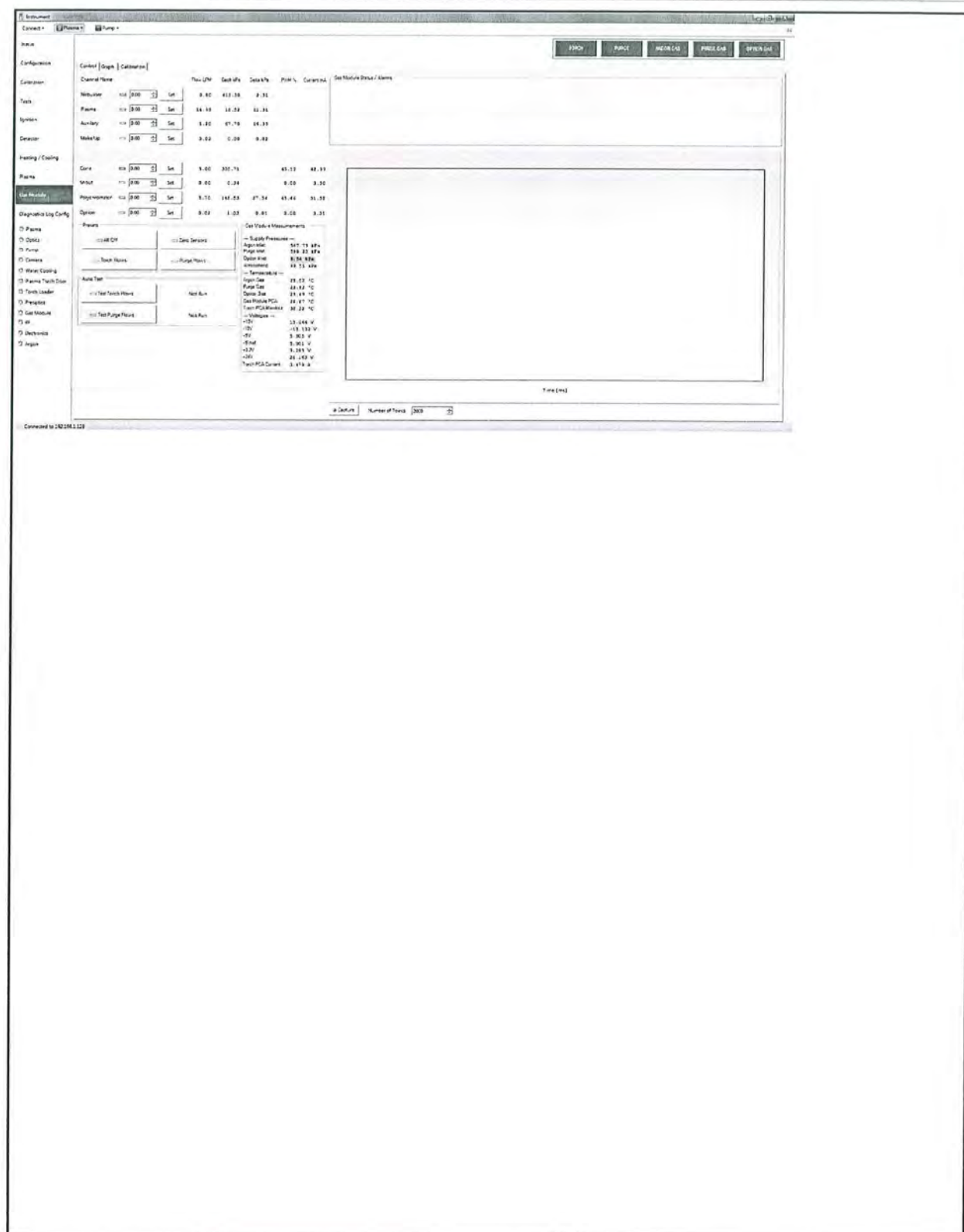




## General

Document Name:

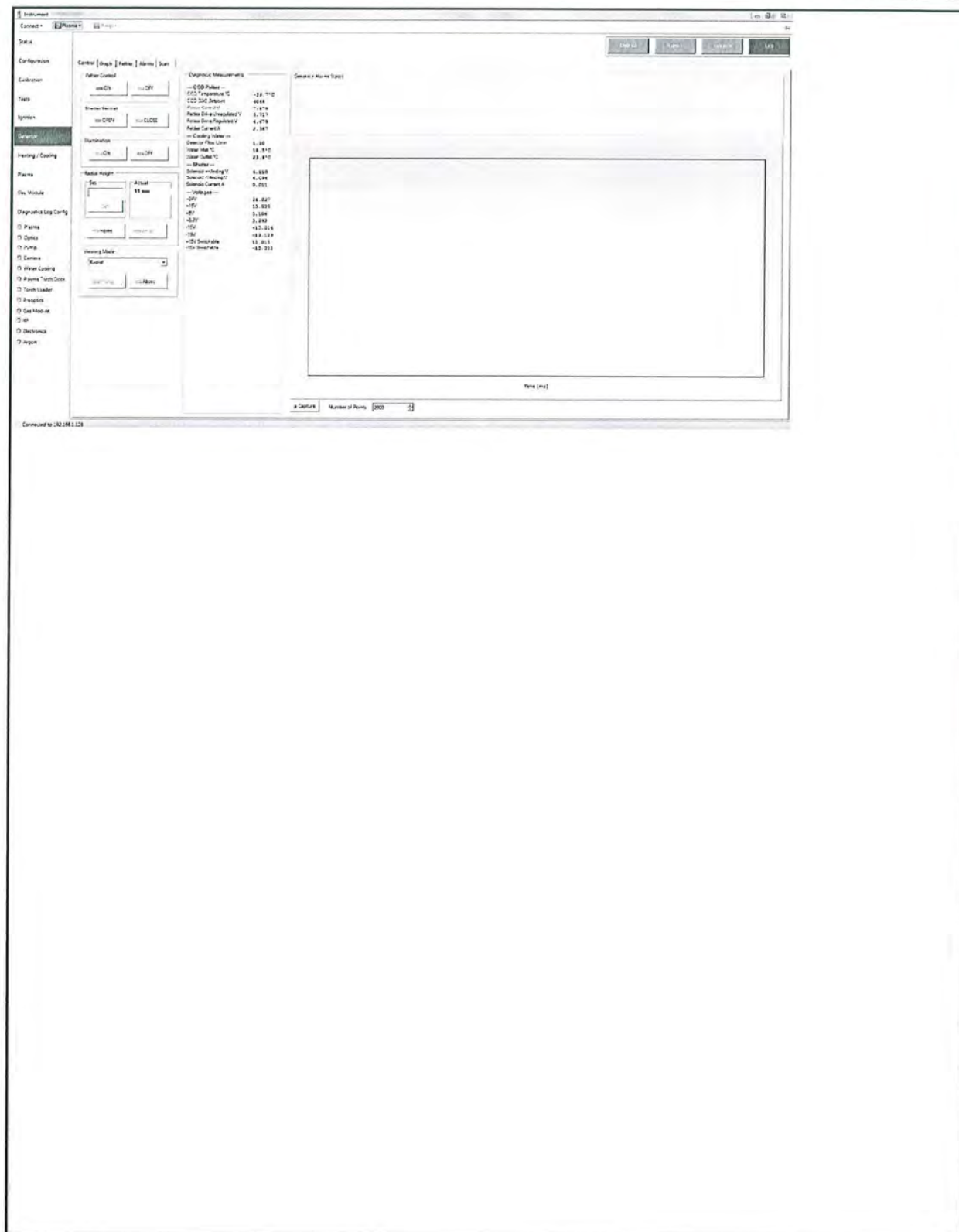
Instrument's Test Report



## General

Document Name:

Instrument's Test Report



Date: November 29, 2021 3:20:41 PM  
System ID: MY15330001



# PinAAcle 900Z Preventive Maintenance Report

Company Name: ENVIRONMENT RESEARCH


Instrument Location: 25/114 M.6 ,THANON NGAM WONG WANG  
THUNG SONG HONG, LAK SI, BANGKOK, 10210

Instrument Serial No.: PZAS19031401

Date: 14-Jun-2021

## ***PinAAcle 900Z Preventive Maintenance (PM)***

<b>Company Name:</b>	ENVIRONMENT RESEARCH		
<b>Address (Instrument Location):</b>	25/114 M.6 ,THANON NGAM WONG WAN, LAK SI, BANGKOK, 10210		
<b>Serial Number:</b>	PZAS19031401	<b>PM Number:</b>	1/2
<b>Customer Name (if applicable):</b>	K. RAIWIN	<b>Telephone Number:</b>	099-182-9241
<b>Customer Support Engineer Name:</b>	K.DUANG	<b>Service Order Number:</b>	WO-01301953
<b>Date PM Performed: (DD-MMM-YYYY)</b>	14-Jun-2021	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	14-Dec-2021
<b>Standard Labor Hours to Complete PM :</b>		<b>5 hours</b>	

Part Number	Release	Publication Date	
09370144 Rev.9	A	January 2018	

### **Scope**

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900Z 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

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	53-255CRY1	30-Sep-2021

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 <sub>3</sub>	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
B3100652 Or N9307029	Electronic Flow Meter	1	PE200767
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

# Procedure Checklist

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

## 1. General:

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

## 2. PC Instrument Software:

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

## 3. Mechanical:

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

#### 4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ 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. After PM Performance tests [THGA]:

##### 7.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min $\pm$ 25 mL/min	255	Passed
External Flow Rate	100 mL/min $\pm$ 10 mL/min	100	Passed

##### 7.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	$\leq$ 0.005 Abs.	0.0010	Passed
Standard Deviation	$\leq$ 0.005	0.0003	Passed

##### 7.3 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 <sub>0</sub> Results	$\leq$ 7.0 pg/0.0044 A-s	3.8	Passed
Precision	$\leq$ 2.0 %	1.02	Passed



#### 7.4 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 <sub>0</sub> Result	≤ 16.5 pg/0.0044 A-s	11.8	Passed
Zeeman Ratio	0.52 ± 0.04	0.56	Passed

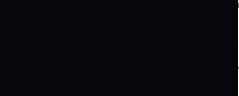

#### 8. Review:

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

## Additional Comments

Additional Comments Regarding the PM	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1934}{0.1934 + 0.1481}$ $= 0.56$

## Review

<p><b><i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.</i></b></p> <p><b><i>This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></b></p>		
<b>Review of Preventive Maintenance:</b>		
Authorized PerkinElmer Representative:		Date: 14-Jun-2021 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:		Date: 14-Jun-2021 <small>(DD-MMM-YYYY)</small>



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CHO6

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Spectrophotometer  
**Manufacturer :** Hach  
**Model :** DR 2700  
**Serial No. :** 1486078  
**ID No. :** ERTC-L-In.-094  
**Condition As-Received:** Used Item  
**Received Date :** 05 January 2022  
**Calibration Date :** 06 January 2022  
**Reference :** 2201-0006ON-14  
**Submitted by :** Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
**Calibration Place :** ห้องปฏิบัติการวิเคราะห์  
**Ambient Temperature :** ( 25.9 - 24.8 ) °C (On-Site)  
**Relative Humidity :** ( 42 - 44 ) % (On-Site)  
**Calibration Procedure :** In - house method :  
CP-OCH4 based on ASTM E 275-01  
**Calibrated by :** Uthen Kankawi  
  
**Approved by :**  
  
( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lerngagtrakul  
**Issue Date :** 19 January 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0036791



Cert. No. : 22CHO6

Page : 2 of 3

**Condition of calibration result**

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	32593	85665	17 July 2022
2. Absorbance Standard set	32596	85666	17 July 2022
3. Wavelength Standard set	29829	94776	02 Sep 2023
4. Wavelength Standard set	29829	94777	02 Sep 2023

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

3. This certificate is traceable to the International System of Unit maintained at :

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral BandWidth : - nm

Scan Speed : - nm/min

**Calibration Results : without adjustment**

**Wavelength Accuracy**

<b>Certified Values of Reference Material ( nm )</b>	<b>UUC Reading ( nm )</b>	<b>Uncertainty of Measurement ( <math>\pm</math> nm )</b>	<b>Coverage Factor <i>k</i></b>
418.40	418	0.59	2.00
537.00	536	0.59	2.00
585.56	586	0.59	2.00
638.00	638	0.59	2.00
879.68	879	0.59	2.00





Cert. No. : 22CHO6

Page : 3 of 3

**Calibration Results : without adjustment**

**Photometric Accuracy**

Wavelength (nm)	Certified Values of Reference Material ( Abs )	UUC Reading ( Abs )	Uncertainty of Measurement ( $\pm$ Abs )	Coverage Factor <i>k</i>
440.0	Zero	0.000	0.0028	2.00
	0.5634	0.558	0.0028	2.00
	0.7024	0.697	0.0028	2.00
	0.9872	0.978	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5267	0.525	0.0028	2.00
	0.7000	0.699	0.0028	2.00
	0.9837	0.981	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5685	0.566	0.0028	2.00
	0.7650	0.761	0.0028	2.00
	1.0761	1.070	0.0028	2.00

**Remark**

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

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

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**Cert.No.:** 22CH7

**Page.:** 1 of 2

## Certificate of Calibration

<b>Equipment :</b>	Conductivity Meter
<b>Manufacturer :</b>	HM DIGITAL
<b>Model :</b>	COM-100
<b>Serial No. :</b>	PONPE5860865
<b>ID No. :</b>	NO.1
<b>Condition As-Received:</b>	Used Item
<b>Received Date :</b>	29 December 2021
<b>Calibration Date :</b>	04 January 2022
<b>Reference :</b>	2112-0752WN-4
<b>Submitted by :</b>	Environment Research & Technology Company Limited. 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210
<b>Ambient Temperature :</b>	(25 $\pm$ 2.5) °C
<b>Relative Humidity :</b>	(50 $\pm$ 15) %
<b>Calibration Procedure:</b>	In -house method : - CP-CH6 : based on direct measurement by using reference material (RM)
<b>Calibrated by :</b>	Walalak Sirithean 
<b>Approved by :</b>	 ( <input checked="" type="checkbox"/> ) Malee Butkruea ( <input type="checkbox"/> ) Saithip Meangmai ( <input type="checkbox"/> ) Warakorn Lernagtrakul
<b>Issue Date :</b>	7 January 2022

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

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Cert.No.: 22CH7

Page.: 2 of 2

**Condition of this result of calibration**

**1. Reference Standard Instrument :-**

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	9549224	130RC003	21I451	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, Thermo Scientific (traceable to NIST)

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
100 $\mu\text{S/cm}$	Thermo Scientific	101/04	12 Mar 2022
1413 $\mu\text{S/cm}$	Thermo Scientific	171/02	30 Apr 2024

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

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

**Calibration results**

**Function : Conductivity Measurement**

**(\*) After Adjustment at 1413  $\mu\text{S/cm}$**

**Conductivity Electrode Serial No.: PONPE5860865**

<b>Standard Conductivity Solution</b>	<b>Before Adjustment UUC* Reading</b>	<b>After Adjustment UUC* Reading</b>	<b>Uncertainty of Measurement (<math>\pm</math>)</b>	<b>Coverage factor k</b>
100 $\mu\text{S/cm}$	95.3 $\mu\text{S/cm}$	98.1 $\mu\text{S/cm}$	5.1 $\mu\text{S/cm}$	2.00
1413 $\mu\text{S/cm}$	1350 $\mu\text{S/cm}$	1410 $\mu\text{S/cm}$	16 $\mu\text{S/cm}$	2.00

**Remark - 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 of approximately 95 %.

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Cert.No.: 22CH6

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** Salinity Meter  
**Manufacturer :** AZ  
**Model :** AZ8371  
**Serial No. :** 298475  
**ID No. :** NO.1  
**Condition As-Received:** Used Item  
**Received Date :** 29 December 2021  
**Calibration Date :** 04 January 2022  
**Reference :** 2112-0752WN-3  
**Submitted by :** Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
**Ambient Temperature :**  $(25 \pm 2.5) ^\circ\text{C}$   
**Relative Humidity :**  $(65 \pm 15) \%$   
**Calibration Procedure:** In - house method : based on direct measurement by  
using Sodium Chloride Solution

**Calibrated by :** Walalak Sirithean

**Approved by :**

Approved Signatory

- ( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul

**Issue Date :**

7 January 2022

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Cert.No.: 22CH6

Page.: 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Thermometer	1963884	130RC114	21I978	17 Sep 2022
2) Thermo-Hygrograph	1103328	130EC010	21H1462	27 June 2022

2. Reference Standard Material :

- Conductivity calibrated solution, Eutech (traceable to NIST)
- Calibrated Total Dissolved Solids solution temperature controlled by Water bath at  $(25 \pm 0.1) ^\circ\text{C}$
- The Total Dissolved Solids has been prepared dilution from

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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. Date</u>
25 ppt	Eutech	230/01	07 June 2023

**Calibration results** ( \* ) Adjustment at 2.84 ppt

Probe Serial No. : 298475

Standard NaCl Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor $k$
2.84 ppt	2.49 ppt	2.83 ppt	0.030 ppt	2.00

**Remark:**

- UUC\* = Unit Under Calibration
- ppt = ppt of NaCl
- ppt = Parts per Thousand

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

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## Agilent 8890 Gas Chromatograph – Installation Checklist

Thank you for purchasing an Agilent **instrument**. This checklist is used by the installing engineer to ensure that the instrument and associated systems are correctly installed, upgraded, and functioning as designed in your facility. This checklist will be completed at the end of the service and provided to you as a record of the installation.

### Customer Information

- Customers should leave the instrument shipment for the engineer to unpack.
- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the installation.
- Some installation tasks will be beneficial to you if you are present – refer to sections in this checklist

### Important Customer Web Links

- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Go to <https://community.agilent.com/welcome>
- Further training, advice, and consultation can be obtained upon request.  
To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our **Support Home page**  
<http://www.agilent.com/search/support>

## Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being installed.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

## Additional Instruction Notes

- There are separate checklists like this one for each major system component installed with the GC. Make sure that all checklists for the system are available prior to beginning the installation.
- User information is available from the touchscreen interface and the manual are available via the web server built into the 8890 GC.
- GC, ALS, MSD and accessory user manuals, the GC Firmware/PID Update Tool, Parts Finder and other tools are included on the " GC and GC/MS User Manuals and Tools" DVD set. These will be installed as part of this GC Installation Procedure.
- Refer to the following 8890 User Manuals as you go through this checklist procedure.
  - Installation and First Startup
  - Operation Manual
  - Maintaining Your GC



## System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument system name and ID	CN 2122A142
Instrument system site and location	Environmat Research
List system component product numbers	List the serial numbers of each component
1. G3540A	1. CN 2122A142
2. G4513A	2. CN21195115
3. G4513A	3. CN21195114
4. G4514A	4. CN2207014
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.



## Preparation

- ☒ Unpack/verify the condition and completeness of shipment. For discrepancies, use the following table.

Product or part description	Observation	Action

- ☒ Discuss any specific questions or issues with the customer before starting.
- ☒ Discuss with the customer the location in the lab and near the instrument where consumables, accessories and tools will be stored.
- ☒ Discuss any configuration options with the customer before starting.
- ☒ Check for required service note applicability and firmware update requirements.
- ☐ Upgrades only – check with customer that instrument control settings, data, methods, etc. have been properly saved or archived before starting any installation procedures.

## Installation Procedure

### Connect cables and Plumb Gasses

- ☒ Place the GC on the bench.
- ☒ Verify line voltage, GC Line power configuration, and power cord match.
- ☒ Compare GC Configuration voltage range from label on the unit with actual voltage at customer site.
  - Voltage Range from Label 220
  - Customer Line Voltage 220.4
- ☒ Plug in power cable and power ON the GC. Confirm Power ON successful.
- ☒ Run the 8890 GC feature tour from the front panel of the GC.
- ☒ Use the 8890 GC Setup Wizard to setup the GC:
  - ☒ Remove shipping caps and tape.
  - ☒ Set the date and time.
  - ☒ Set the pressure units.
  - ☒ Configure gas types
  - ☒ Configure the network settings.
  - ☒ Connect the gasses.
  - ☐ Install Tank Regulators and purge out the air as required
  - ☒ Connect tubing to the tank regulators or house gas supply
  - ☒ Install gas traps - purge each with carrier before connecting the next trap or the fitting to the GC
  - ☒ Connect supply gases to the GC and Leak check/Pressure Test all gas connections.
- ☒ Install and configure the ALS.
- ☐ If an 8890 GC is being installed with a 5977 MSD, configure the MS. Refer to the GC-MS Features section in the 8890 GC Operation Manual for instruction.
- ☒ Connect the external cables, including LAN, signal output, and/or remote cables.
- ☐ If the GC includes an Electron Capture Detector, connect the exhaust tubing to a proper vent or fume hood.
- ☐ If the GC includes cryogenic cooling, connect cryogenic coolant.
  - For LN2 use 1/4" Swagelok and insulated copper tubing @ 25-40 PSI
  - For CO2 use 1/8" Swagelok and Stainless Steel tubing @ 800-1000 PSI.
- ☐ If GC includes valves, connect valve actuator air using 1/4" plastic/PTFE - 50 PSI clean/dry Air.
- ☐ If a headspace or other sampler is included install per the specific Installation Checklist.

## Install User Manuals and Update Instrument Firmware

- ☒ From the "GC and GCMS User Manuals and Tools" DVD set, install the following:
  - "Instrument Manuals" for all modules installed on the GC system - i.e. 8890 GC, 7693 ALS, 7697 Headspace Sampler etc.
  - "GC Firmware Update Tool" - Update the Firmware on all instrument modules as required - Before performing the updates, check with the customer and check that firmware is compatible with all components in the system
  - "Parts Finder" - Demonstrate how to find and order parts for maintaining the customer's system
  - Install the "Method Developer Tools" as applicable to the System configuration.

## Column Connection, Conditioning and Bakeout (Customer present)

- ☒ Install HP-5 or other Agilent checkout column to the GC, and confirm column flow, and purge with carrier at ambient temperature for 5 minutes.
- ☒ Perform the Leak and Restriction Test from the GC Touchscreen User Interface.
- ☐ Set the gas flows to the Detector and Set to Operating Temperature. Light the Flame or Turn on the TCD Filament etc.
- ☒ Bake out inlet, column, and detector.
- ☒ Repeat for all inlets and detectors installed.

## Install Agilent Data System Software (if Included)

- ☐ Section not applicable
- ☒ Install any Agilent Data System PC and Software if included with the GC system.
- ☒ Create links to the GC Browser Interface and GC Help and Information on the PC OS Desktop.
- ☐ Launch and Configure the Agilent Data System Software to the GC system.

## Installation Checkout (Customer present)

- ☒ Locate the inlet/detector checkout method. (8890 Operation Manual).
- ☒ Install the syringe in the Auto-sampler and configure as required. (ALS User Manual)
- ☒ Transfer the Agilent checkout sample for the detector being tested into a screw cap vial or other sampler vial.
- ☒ Load solvent and waste vials into the Auto-sampler turret. (ALS User Manual)
- ☒ Use the Agilent Data System to enter the checkout conditions.

- ☒ Save the **"Checkout Method"**
- ☒ Create and Save a System **"Bakeout Method"** - Bakeout the entire system for 15 minutes
  - Split Vent flow > 100 ml/min
  - Inlet/Detector 20-50 degrees above the Checkout Method Temps,
  - Oven 20-50 degrees hotter than Method Final Temp
- ☒ Reload the **"Checkout Method"**
- ☒ When the temperatures and detector output is stable, perform one injection of checkout sample.
- ☒ Compare the resulting chromatogram with the typical results documented in the 8890 GC "Operation Manual".
- ☒ Repeat for other Detectors if installed.
- ☒ Review the results with the customer.



## Service Review

- ☐ Attach available reports/printouts to this documentation.
- ☒ Record the time/date of installation or upgrade completion in the customer's records/logbook.
- ☒ Complete the following Service Engineer comments section if there are additional comments.
- ☒ Review the installation/upgrade with the customer.
- ☒ Explain Agilent warranty for instruments.
- ☒ Explain how to use manuals, guides, and online help.
- ☒ Explain how to get self-help, and FAQs online.
- ☒ Explain how to log an instrument service call and support services that are available.
- ☒ Advise customer of additional instrument training options.
- ☒ If the instrument firmware was updated, record the details of the change in the service engineer's comments box or if necessary, in the customer's IQ records.
- ☒ Supply the customer with a copy of the Smart Alerts flyer.
- ☒ Describe Smart Alerts to the customer.
- ☒ Install Smart Alerts if requested.

## 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 include them in this box.

## Service Completion

Service request number [REDACTED] Date service completed 1 Aug 2021

Agilent signature [REDACTED] Customer signature \_\_\_\_\_

Total number of pages in this document 7



# Sound Level Meter Calibration Report

Support Equipment Type	: Sound Level Calibrator
Manufacture	: Larson Davis
Model	: CAL114
Serial No.	: 590043
Range of Calibrator	
- Sound Pressure Level	: 94.1 dB.
- Frequency	: 1,000 Hz.
Calibrated By	: Mr.Apiwat Chamnanweeh
Calibration Date	: August 20, 2022
Customer Name	: Vision E. Consultants Co., Ltd. : โครงการการผลิตปิโตรเลียมแปลงสัมปทานปิโตรเลียมบนบกหมายเลข L21/43 ฐานหลุมผลิตบึงม่วงใต้ 1 (BMS1)

[illegible]

Checked By

Mr. Prayun Detkla  
Technician

oxvi research  
OXVI RESEARCH & TECHNOLOGY CO., LTD.  
Approved By

Ms.Sutatip Im-noi  
Environmental Scientist



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0412

MTC No. EEL. BP. 133/0365

## CALIBRATION CERTIFICATE

Submitted by : Environment Research & Technology Co., Ltd.  
Address : 25/114 Moo 6, Soi Chinakert 1, Ngamwongwan Rd., Toongsonghong, Lakki, Bangkok 10210.  
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 : LARSON DAVIS  
Model : CA 114  
Serial No. : 590043  
Standards used : 1. Digital Function Synthesizer NF Electronic DP-193A S/N 122037.  
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.  
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.  
4. Digital Multimeter Agilent 34401A S/N MY44005560.  
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.  
6. Audio Analyzer Keithley 2015-P S/N 4106495.  
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

### Ambient Environment

Temperature : (23 ± 3) °C  
Relative Humidity : (50 ± 15) %  
Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

Date of Receipt : 25 Mar. 2022

Date of Calibration : 25 Mar. 2022

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0412

MTC No. EEL. BP. 133/0365

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

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

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

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	94.08	0.08	± 0.10	± 0.75 dB

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1000.7	0.7	± 1.5	± 2.0%

### 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.92	± 0.50	± 4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :

(Mr.Nutapong Niljitsavanit)

(Mr.Tawikiat Jansamran)

Date of Calibration : 29 Mar. 2022

Date of Issue : 31 Mar. 2022

End of Certificate

Ref : 2011265032501467001

2 / 2

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

FMBL/MTC.002 Rev.4

## Certificate of Calibration

### Product Information:

Meter Model	PHTEST30- POCKET PH TESTER
Serial Number	3066352
Calibration Date	15-Dec-2021

1st Calibration Point	pH 7.00
2nd Calibration Point	pH 4.01
3rd Calibration Point	pH 10.01

This meter has been calibrated, tested and certified to meet all performance specifications.

Approved By

**ThermoFisher Scientific**  
**Water and Lab Products**  
**Quality Assurance**

This is a computer-generated document. No signature is required.



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

Cert.No.: 22TW242  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115  
Serial No. : 17H104220  
ID No. : ERTC-L-In.137  
Received Date : 26 October 2022  
Test Date : 27 October 2022  
Reference : 2210-0840WN-1

Submitted by : Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Lakki, Bangkok 10210

Laboratory Condition :

Temperature (  $25 \pm 5$  ) °C

Humidity (  $50 \pm 20$  ) %

In - house method : CP-CH9

by Comparison Technique with Azide Modification Method

Test Procedure :

Tested by :

Walalak Sirithean

Approved by :

Approved Signatory

( ☒ ) Malee Bulkrea  
( ☐ ) Seithip Meangmai  
( ☐ ) Warakorn Lerngagrakul

Issue Date :

1 November 2022



Cert.No.: 22TW242  
Page.: 2 of 2

### Condition of this result of calibration

#### 1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

#### 2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15K100353

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.14	8.13	0.0071

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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45/48 Soi Salathammassop 31, Salathammassop Rd.,  
Salathammassop, Thaweewathana, Bangkok 10170 Thailand  
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



## CERTIFICATE OF CALIBRATION

Issue Date : 28 December 2021  
Certificate No. : 21-1224-004  
Work Order No. : 21/1224

Customer Name : Environment research & Technology Co., Ltd.  
25/114 Moo6 Soi Chinakert1, Ngarmwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
Date of Received : 15 December 2021  
Date of Calibration : 15 December 2021

Instrument Details : Description : Temperature Controlled Enclosures (Incubator)

Manufacturer : Accuplus  
Model : Smart 1250  
Serial No. : 2059-0218-0002  
ID No. : ERTC-L-IN-143  
Resolution : 0.1 °C  
Location : Laboratory

Calibration Method : This instrument was calibrated by insert standard thermometer into the chamber according to calibration procedure no. CWI-T-10 follow up to TLAS G-20-1/02-08  
(E) : Guidelines for Calibration and Checks of Temperature Controlled Enclosures.

Environmental Conditions :

Temperature : Area Monitoring between 15°C to 40°C  
Humidity : Area Monitoring between 30%RH to 85%RH  
Line Voltage : Area Monitoring 220 VAC ± 10%

Traceability of Measurement :

This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by : Mr. Sittisak Tonglim  
Approved by :  
Calibration Engineer

Laboratory Manager

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Crystal Calibration Sales and Service Co., Ltd.

45/48 Salathammassop 31, Salathammassop Rd., Salathammassop, Thaweewathana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 http://www.crystalcal.com Email : info@crystalcal.com



15-1-15



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.  
45/48 Soi Salathammassop 31, Salathammassop Rd.,  
Salathammassop, Thaweewathana, Bangkok 10170 Thailand  
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



## CERTIFICATE OF CALIBRATION

Issue Date : 28 December 2021  
Certificate No. : 21-1224-004  
Work Order No. : 21/1224

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY57006241	21-719-014	03 September 2022
Sensor type	RTD	RTDH 101-109	21-719-014	03 September 2022

2. Certificate traceable

: This certificate traceable to The International System of Unit refer to  
Crystal Calibration Sales and Service Co., Ltd., NAC Calibration No. 0260

3. Condition of item

: Used

4. Calibration site

: On - Site

5. Result of Calibration

: Without adjustment

6. Evaluate Condition

: Time Constant

: Hour

: 50 Minute

: At cal. point

: 20 °C

7. Calibration note

: The results reported in this certificate refer to the condition of instrument on the process into the steady state of chamber

8. Sensors Installation Diagram

: When ; Sensor installation location in Chamber @ Working Space

A = Distance between sensor and wall of chamber is 5 cm

9. Dimensions of chamber

: W = 0.5 m ; D = 0.5 m ; H = 0.9 m

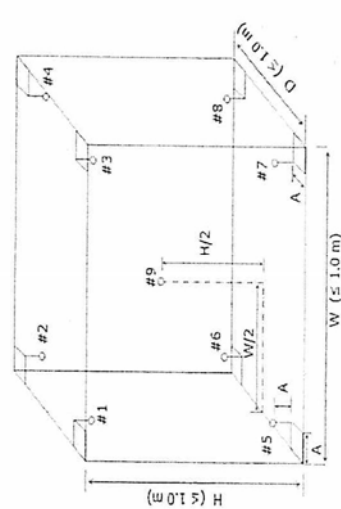


Diagram of Chamber





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45/48 Soi Salathammassop31, Salathammassop Rd.,  
Salathammassop, Thaweewatthana, Bangkok 10170 Thailand  
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



## CERTIFICATE OF CALIBRATION

Certificate No. : 21-1224-004  
Work Order No. : 21/1224

Issue Date : 28 December 2021

### Result of Temperature Distribution and Performance Check

Table1 : Reporting of Temperature Distribution

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.26	20.08	20.22	20.11	20.18	20.12	20.09	20.16	19.91	0.60

Table 2 : Reporting of Performance check

Indicator	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
Set Point (°C)	20.0	19.6	19.9	0.39	0.58	1.03

#### Note

Customer would like to find internal temperature in chamber and this report customer request and accepted in certificate

The reference sensor is preferably located of the geometric center of chamber

The measured temperature data readout by software "Benchmark Datalogger 3"

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

Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions.

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

Indicating Temperature - the average reading of indicating device that forms the integral part of the enclosure.

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

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

-END-

19-1-65 PAGE 3/3



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM154  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Ehret  
Model : BK 4106  
Serial No. : 22162  
ID No. : ERTC-L-In.-022

Submitted by : Environment Research & Technology Company Limited  
25/114 Moo 6 Soi Chinakel 1,  
Ngamwongwan Road, Toongsonghong, Laksi,  
Bangkok 10210  
Location : 408/2 ห้องปฏิบัติการมาตรฐานอาหารสิ่งแวดล้อม

Received Order : 5 January 2022  
Calibration Date : 6 January 2022  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Ponthippa Tameyakul  
(✓) Malee Bulkruea  
( ) Suwit Imjai

Issue Date : 19 January 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

26-1-65

A 0036712



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2201-0006ON-6  
Procedure Used :-

Cert. No.: 22TM154  
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD ).  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

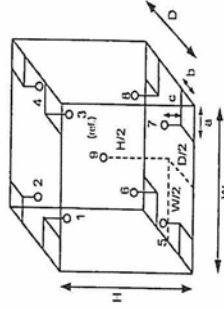
1. Reference standard instrument:-  
Instrument Model Serial No. Cert. No. Due Date  
1 ) Data Acquisition 34970A MY44031769 21LM12 02 Sep 2022  
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	56	58
AC Supply ( Volt )	221	222



### Probe Installation Details :

a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.60 m  
c = 5.0 cm H = 0.50 m  
Capacity = 0.15 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	9RTD-2/1
2	9RTD-2/2
3	9RTD-2/3
4	9RTD-2/4
5	9RTD-2/5
6	9RTD-2/6
7	9RTD-2/7
8	9RTD-2/8
9 (ref.)	9RTD-2/9

26-1-65

a 1089975



Equipment : Incubator  
Condition As-Received :  
Reference : 2201-0006ON-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM154  
Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
44.5	44.5	45.0	0.20	0.98	1.7	0.7	2
Measured Temperature ( °C )							
Position							
1	2	3	4	5	6	7	8
44.5	44.990	45.152	45.203	45.279	43.789	44.155	44.530
							44.745

Average\* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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## SERVICE REPORT

**Customer Contact:**  
Environment Research & Technology  
Co Ltd

Head Office  
Ngamwongwan Rd  
25/114 Moo 6 Soi Chinnakhet 1  
TAX ID : 0105542064981  
Raiwin@enviresearch.co.th  
0895030467

**Invoice To:**  
Environment Research & Technology  
Co Ltd  
Head Office  
Ngamwongwan Rd 25/114 Moo 6 Soi  
Chinnakhet 1 Thungsonghong Luksi

**Payer:**  
World Siam Group Co Ltd Head  
Office  
126/8 3D Floor Thai Sri Bldg.,  
Krungthoburi Road, Banglamphu-Lang  
Klong San  
BANGKOK 10600  
**Delivery Site:**  
Environment Research & Technology  
Co Ltd  
Head Office  
Ngamwongwan Rd  
25/114 Moo 6 Soi Chinnakhet 1

**Location:**  
Room  
Bldg  
Lab  
Dept

<b>Customer Purchase Order Number:</b>	70472666
<b>Service Request:</b>	<b>Service Request Date:</b>
<b>Service Order:</b>	<b>Service Confirmation:</b>
6004983683	6903908836

### Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IO-5100	ICP-OES 5100/5110 System			
G8481A	Water chiller	1A1560387		SYS-IO-5100
G8011A	Agilent 5100 VDV ICP-OES Spectrometer	MY15330001		SYS-IO-5100
G8410A	SPS 4 Autosampler	AU15220240		SYS-IO-5100

### Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
2000	PM	Preventive Maintenance	1.00	Agreement Entitlement - 100 % covered	18.11.2021	18.11.2021
2040	G8010-68015	Spare pre-optic window rad.5100 ICP 1/pk	1.00	Agreement Entitlement - 100 % covered		
2030	G8010-68014	Spare pre-optic window ax.5100 ICP 1/pk	1.00	Agreement Entitlement - 100 % covered		
2020	G8010-60136	Filter Argon ICP-OES 5100 Series	1.00	Agreement Entitlement - 100 % covered		
2010	G8000-68002	Inlet cooling air filter for MP-AES	1.00	Agreement Entitlement - 100 % covered		

### Additional Information:

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Thailand

Agilent Technologies (Thailand) Limited, Head Office  
U Chu Liang Bldg. 22/F Unit A.D  
968 Rama 4 Road, SIlom, Bangkok,  
Bangkok 10500 Thailand  
Tax ID : 0105542068218





Agilent CrossLab Compliance

Qualification Type: ES-OQ

System ID: MY15330001

EQP Name: AgilentRecommended

EQP Revision: ES.02.50

EQP Publish Date: March 2020

Date: November 29, 2021 3:20:41 PM

Report Type: Report

Org. Name: Environment Research & Technology Co., Ltd

Org. Location: 25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd., Bangkok 10210

Service Information:	
Problem Description: T-WM-S-PM00-105100-50000961745	
Service Provided: Discuss any issues with the customer prior to starting/ perform to preventive maintenance checklist and replace parts	
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service	
Reported Hours: 4.0	Travel Hours: 2.0
Customer Field Service Representative Name: Piyawit Sonpanithan	Customer Field Service Representative Signature: [Redacted] Date: 18 Nov 2021
Customer Name: RAIWIN POSIT	Customer Signature: [Redacted] Date: 18 Nov 2021
Additional Comments:	

Table of Contents

Section	Page
Cover page	1
Table of Contents	2
Test Summary	3
Service Details	4
Instrument Details	5
Protocol Details	6
Tests	7
Preparation : 5100 VDV	7
Instrument Tests : 5100 VDV	10
Autosampler Operation : Autosampler 1 - SPS4	11
Declaration of Change Control	12
Attachments	13
Signature	29
Transaction Logs	30

Test Summary

Purpose

This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

Details	Status	Runs
Test		
Preparation : 5100 VDV	Pass	1
Instrument Tests : 5100 VDV	Pass	1
Autosampler Operation : Autosampler 1 - SPS4	Pass	1
Overall Qualification Status		
Pass		

## Service Details

### Purpose

This section includes local contact and delivery details for this service.

### General Details

Service Order No./Request: 6004983683  
EQP Name: AgilentRecommended  
EQP Revision: ES.02.50  
Report Type: Report  
Organization Details  
Name: Environment Research & Technology Co., Ltd  
Location: 25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd., Bangkok 10210

### Local Contact Details

Name: Khun Raiwin Posit  
Job Title: Supervisor Scientist  
Qualification Location: ICPOES Room

### Operator Details

Name: Kanyakorn Sukpathrajareon  
Job Title: Field Service Engineer

### Data Acquisition Details

Acquisition Software Name: ICP Expert  
Acquisition Software Revision: 7.1.0.6821

### Customer Data System (CDS):

Es: ICP Expert

## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### Spectrometer 1

Manufacturer: Agilent Technologies  
Name: 5100 VDV  
Model Number: G8011A  
Sample Introduction: Double pass glass cyclonic spraychamber and seaspray nebulizer  
Serial Number: MY15330001  
Firmware Revision: 2994

#### Chiller 1

Manufacturer: Agilent Technologies  
Name: Chiller  
Model Number: G8481A  
Serial Number: 1A1560387

#### Autosampler 1

Manufacturer: Agilent Technologies  
Name: SPS4  
Model Number: G8410A  
Serial Number: AU15220240

Protocol Details

Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ES.02.50	Autosampler Operation
ES.02.50	Instrument Tests
ES.02.50	Preparation

Preparation

Purpose

This test records a status for each preparation task for the Agilent ICP-OES.

Configuration Details

Model/Serial No.:

GS011A

MY15330001

Results

Criteria

Observed Result

Expected Result

Status

Does the plasma ignite successfully in the first three attempts?

Yes

Yes

Pass

Was the detector calibration performed and completed successfully?

Yes

Yes

Pass

Was the instrument calibration performed and completed successfully?

Yes

Yes

Pass

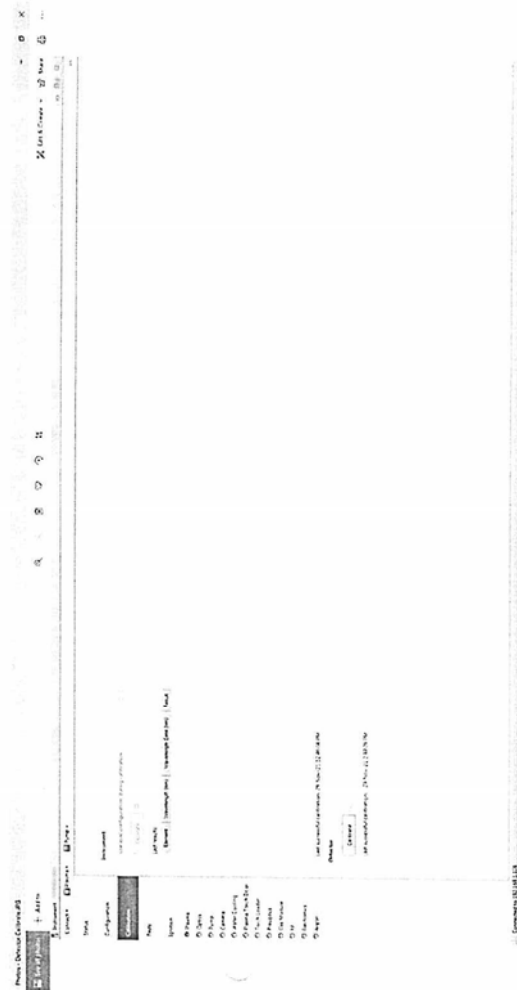


# Test Evidence

Image Details: Was the detector calibration performed and completed successfully?

Date and Time: November 29, 2021 3:09:22 PM

Host Name: 5CG9231J5L



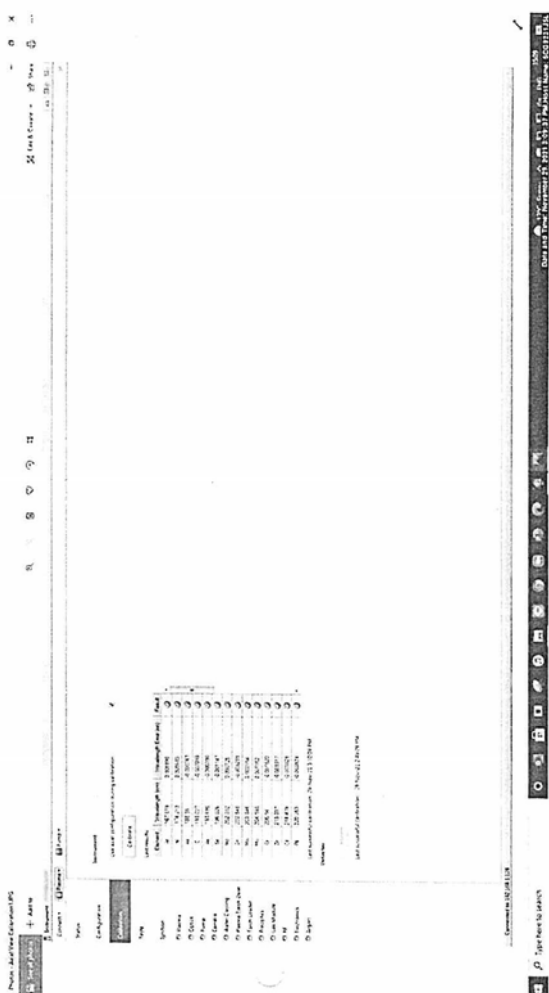
Overall Test Status: Pass

Runs: 1

Image Details:

Date and Time: November 29, 2021 3:09:37 PM

Host Name: 5CG9231J5L



Overall Test Status: Pass

Runs: 1

## Instrument Tests

## Purpose

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

## Configuration Details

Model/Serial No.:

G8011A

MY15330001

## Results

Observed Result

Expected Result

Status

Are the Functional Tests results within acceptance criteria?

Subsystem Communications

Air Flow

Yes

Yes

Pass

Water Flow

Yes

Yes

Pass

Gas Flows

Yes

Yes

Pass

RF Generator

Yes

Yes

Pass

Camera

Yes

Yes

Pass

Optics

Yes

Yes

Pass

Are the Instrument Performance Tests results within acceptance criteria?

Resolution

Yes

Yes

Pass

Sensitivity

Yes

Yes

Pass

Precision

Yes

Yes

Pass

## Overall Test Status

Pass

Runs: 1

Date:

November 29, 2021 3:20:41 PM

System ID:

MY15330001

## Autosampler Operation

## Purpose

This test verifies that the autosampler operates properly.

## Configuration Details

Model/Serial No.:

G8410A

AU15220240

## Results

Criteria

Observed Result

Expected Result

Status

Does the autosampler successfully move to the specified location(s)?

Yes

Yes

Pass

Overall Test Status

Pass

Runs: 1

Date:

November 29, 2021 3:20:41 PM

System ID:

MY15330001

## Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

## Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.


Location	Category	Document Name	Page
EQR	General	Certificate of Qualification for ACE	14
EQR	General	Certificate of Qualification for ACE	15
EQR	General	Operator's training certificate and qualifications	16
EQR	General	Certificate of Qualification for ACE	17
EQR	Material	Certificate of Analysis Wavelength calibration solution	18
EQR	General	Instrument's Test Report	22
EQR	General	Instrument's Test Report	25
EQR	General	Instrument's Test Report	26
EQR	General	Instrument's Test Report	27
EQR	General	Instrument's Test Report	28

Document Name:

Certificate of Qualification for ACE

Document Name:

Certificate of Qualification for ACE



### Agilent Technologies

## Agilent Compliance Engine Self Qualification

Date: November 29, 2021 3:10:26 PM

Drive Serial #: EAF04572


Platform Revision: ACE 3.11

Individual self-qualification reports for each specific technique installed are also available upon request. They provide additional details on the general report from the concise summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Emission Spectroscopy	3	Conforms
Software	6	Conforms

Overall Qualification Status

Conforms



### Agilent Technologies

## Certificate of Completion

Learner Name: Kanyakorn Sukpathajarn

Title Of Course: AN-CU-SS-II-030-A: ACE 3.X User Update Training

Completion Date: June 25, 2020

Certified By Company: Learning at Agilent


All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current information, and other service and support materials. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.



Document Name:

Certificate of Qualification for ACE



Certificate of Completion


Learner Name:	Kanyakorn Sukpathrajarn
Title Of Course:	ANV-CE-ICPOES-2-007-C: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-OES Systems
Completion Date:	October 30, 2020
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Document Name:

Operator's training certificate and qualifications



Certificate of Completion

Learner Name:	Kanyakorn Sukpathrajarn
Title Of Course:	ANV-CE-ICPOES-2-008-A: Agilent 5100 ICP-OES Support Neophyte Training
Completion Date:	November 2, 2017
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Materials

Document Name:

Certificate of Analysis Wavelength calibration solution

Document Name:

Certificate of Analysis Wavelength calibration solution



# CERTIFICATE OF ANALYSIS

Agilent Product Name: Wavelength Calibration Solution (ICP-QES & MP-AES, 5 mg/L, 50mL)  
Agilent Part No: 4410030100  
Lot No: 001095902

## Product Specifications

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO <sub>3</sub> ) <sub>3</sub>	7784-37-2	5.003 ± 0.025 mg/L	As	As <sub>2</sub> O <sub>3</sub>	1327-56-5	5.001 ± 0.025 mg/L
Ar	Ar	7440-38-2	5.002 ± 0.025 mg/L	Ba	Ba(NO <sub>3</sub> ) <sub>2</sub>	1327-56-5	5.001 ± 0.025 mg/L
Ba	Ba(NO <sub>3</sub> ) <sub>2</sub>	10272-31-6	4.999 ± 0.025 mg/L	Be	Be	7440-07-4	5.001 ± 0.025 mg/L
Bi	Bi	7440-43-9	5.002 ± 0.025 mg/L	Pb	Pb	7440-10-1	4.998 ± 0.025 mg/L
Ca	Ca	7440-48-4	5.002 ± 0.025 mg/L	Se	Se	7782-49-2	5.003 ± 0.025 mg/L
Cr	Cr(NO <sub>3</sub> ) <sub>3</sub>	1327-56-5	5.001 ± 0.025 mg/L	Sr	Sr(NO <sub>3</sub> ) <sub>2</sub>	10042-76-9	5.001 ± 0.025 mg/L
Cu	Cu	7440-50-8	5.003 ± 0.025 mg/L	Zn	Zn	7440-66-6	5.002 ± 0.025 mg/L
K	KNO <sub>3</sub>	7757-79-1	50.00 ± 0.25 mg/L				

Matrix: 5% HNO<sub>3</sub>

Intended Use: This solution is intended for use as a certified reference material or calibration standard for inductively coupled plasma optical emission spectrometry (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), atomic absorption spectrometry (AAS or GF-AAS), microwave plasma atomic emission spectrometry (MP-AES), x-ray fluorescence spectrometry (XRF), and other techniques for elemental analysis.

**Certification & Traceability:** This CRM was manufactured under a quality management system that is registered to ISO 9001:2015 and ISO/IEC 17025. This CRM was prepared to the certified concentrations shown above by gravimetric methods using single element concentrates that were certified using the "High Performance (HP-QES)" protocol developed by NIST and are directly traceable to the NIST SRMs listed below. This solution was stabilized using high purity nitric acid (HNO<sub>3</sub>) and diluted with filtered (0.22µm), 18 M-ohm deionized water. The balances used in the preparation of this CRM are calibrated regularly with traceability to NIST. All volumetric dilutions are performed in Class A calibrated glassware. The certified concentrations were determined based upon gravimetric procedures. Secondary verification of the certified concentrations was performed using ICP-OES that was calibrated and/or referenced against NIST SRMs: 3101a, 3103a, 3184a, 3102, 3111, 3112a, 3114, 3115, 3121, 3124, 3126, 3143, 3152a, and 3162a. The uncertainty associated with each certified concentration represents the expanded uncertainty at the 95% confidence level using a coverage factor of k=2.

**Instructions for Use:** Agilent recommends that the solution be thoroughly mixed by repeated shaking or swirling of the bottle immediately prior to use. To achieve the highest accuracy the analyst should: (1) use only recommended and transferware, (2) avoid spilling directly from the CRM's original container, (3) use a minimum subsample volume of 500µL, (4) make dilutions using calibrated balances or certified volumetric glassware (flasks and pipettes), (5) dilute in solution the same matrix as the original CRM, and (6) never pour used product back into the original container. The solution should be kept tightly capped and stored under normal laboratory conditions. Do not freeze, heat, or expose to direct sunlight. Minimize exposure to moisture or high humidity.

Page 1 of 3



Period of Validity: Agilent ensures the accuracy of this solution until the expiration date shown below provided the instructions for use are followed. During the period of validity, the purchaser will be notified if this product is recalled due to any significant changes in the stability of the solution.

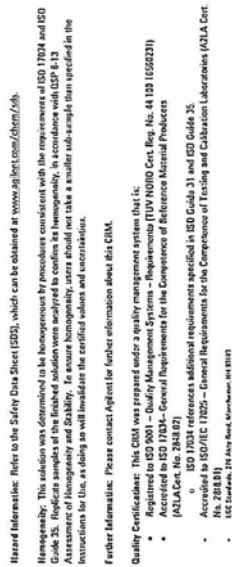
Sample lot approval:

Date of release: 17 October 2020  
Date of expiration: 17 April 2022

Page 2 of 3

Certificate of Analysis Wavelength calibration solution

Certificate of Analysis Wavelength calibration solution



Page 3 of 3

Page 21 / 32

General

Document Name:

Instrument's Test Report

Document Name:

Instrument's Test Report

**Report Summary**

Instrument Model Agilent 5100 VDV CP-OES  
Instrument ID G8011A  
Instrument Serial Number MY15330001  
Software Version 7.1.0.6821  
Firmware Version 2894  
Tested By Kanyakorn S.  
Test Completed On 29-Nov-21 3:18:24 PM

**Result Summary**

Resolution Test Pass  
Sensitivity Test Pass  
Precision Test Pass

**Resolution Test**

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.54
As (188.980 nm)	≤ 8.20	6.72
C (193.027 nm)	≤ 11.50	8.01
Mo (202.032 nm)	≤ 8.20	6.80
Cr (206.158 nm)	≤ 13.40	10.24
Zn (213.857 nm)	≤ 8.70	7.54
Pb (220.353 nm)	≤ 9.50	7.71
Co (228.615 nm)	≤ 17.20	11.30
Ba (228.424 nm)	≤ 9.40	8.19
Mn (257.610 nm)	≤ 13.30	9.60
Mn (260.568 nm)	≤ 20.30	16.52
Cr (267.716 nm)	≤ 11.00	9.08
Cu (324.754 nm)	≤ 25.00	18.23
Cu (327.395 nm)	≤ 14.20	12.53
Sr (338.071 nm)	≤ 33.50	27.38
Ba (455.403 nm)	≤ 44.00	34.14
Sr (400.793 nm)	≤ 38.00	21.93
Ba (493.408 nm)	≤ 38.00	29.13
Ba (614.171 nm)	≤ 42.00	27.47
Ar (675.283 nm)	≤ 74.00	67.94
K (766.491 nm)	≤ 80.00	63.70

Page 1 of 3

**Sensitivity Test****Radial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	122.4	1199.1	83.2
Se (196.026 nm)	≥ 41.0	SRBR	79.1	935.2	109.1
Zn (213.857 nm)	≥ 1421.0	SRBR	3206.2	52338.5	263.8
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2836.4	233.0
Mn (257.610 nm)	≥ 3518.0	SRBR	10494.0	295474.0	737.6
Al (396.152 nm)	≥ 3.4	SBR	5.7	37125.2	5560.4
Ba (493.408 nm)	≥ 34.0	SBR	84.3	1024562.6	12016.8
K (766.491 nm)	≥ 1.8	SUR	3.9	104539.1	21328.3

**Axial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	276.1	4320.0	220.4
Se (196.026 nm)	≥ 159.0	SRBR	179.5	3290.1	281.0
Zn (206.200 nm)	≥ 234.0	SRBR	1432.3	22017.4	231.4
Zn (213.857 nm)	≥ 1743.0	SRBR	6972.3	204965.9	857.0
Pb (220.353 nm)	≥ 320.0	SRBR	600.5	163528.6	436.1
Mn (257.610 nm)	≥ 10625.0	SRBR	31358.8	1574284.8	2512.2
Cr (267.716 nm)	≥ 1048.0	SRBR	4587.3	186346.2	1621.6
Cu (324.754 nm)	≥ 19.0	SBR	51.8	253941.6	4813.6
Al (396.152 nm)	≥ 6.0	SBR	12.4	263070.7	19621.4
Ba (493.408 nm)	≥ 60.0	SBR	190.6	6858283.6	35799.9
K (766.491 nm)	≥ 24.0	SBR	63.4	3363913.7	52206.8

Page 2 of 3

## Document Name:

Instrument's Test Report

## Document Name:

Instrument's Test Report

## Precision Test

Radial

Pass

Element Wavelength	Specification	Measured Value % RSD
As (188.900 nm)	≤ 2.60	1.19
Se (196.026 nm)	≤ 2.60	1.14
Zn (213.857 nm)	≤ 1.50	0.47
Pb (220.353 nm)	≤ 2.60	0.84
Mn (257.610 nm)	≤ 1.50	0.42
Al (396.152 nm)	≤ 1.50	0.37
Ba (493.408 nm)	≤ 1.50	0.77
K (766.491 nm)	≤ 1.50	0.29

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.900 nm)	≤ 1.50	0.68
Se (196.026 nm)	≤ 1.50	0.64
Zn (206.209 nm)	≤ 1.50	0.29
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.34
Pb (220.353 nm)	≤ 1.50	0.33
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.29
Cu (324.754 nm)	≤ 1.50	0.37
Al (396.152 nm)	≤ 1.50	0.35
Ba (493.408 nm)	≤ 1.50	0.55
K (766.491 nm)	≤ 1.50	0.60

Page 3 of 3



Document Name:

Instrument's Test Report



Document Name:

Instrument's Test Report



General

Document Name:

Instrument's Test Report





# PinAAcle 900Z Preventive Maintenance Report

Company Name: ENVIRONMENT RESEARCH

Instrument Location: 25/114 M.6, THANON NGAMWONGWAN

THUNG SONG HONG, LAKSI, BANGKOK, 10210

Instrument Serial No.: PZAS19031401

Date: 28-Jun-2022

PinAAcle 900Z Preventive Maintenance (PM)				
Company Name:	ENVIRONMENT RESEARCH			
Address (Instrument Location):	25/114 M.6, THANON NGAMWONGWAN, THUNG SONG HONG, LAKSI, BANGKOK			
Serial Number:	PZAS19031401	PM Number:	1/2	
Customer Name (if applicable):	K. RAIWIN	Telephone Number:	099-182-9241	
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-01710018	
Date PM Performed: (DD-MM-YY)	28-Jun-2022	Next PM Due Date: (DD-MM-YY)	28-Dec-2022	
Standard Labor Hours to Complete PM :			5 hours	

Part Number	Release	Publication Date
09370144 Rev.9	A	January 2018

**Scope**  
The purpose of this PM is to ensure the continued functionality of the PinAAcle 900Z 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

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
B3002013	THGA Contact Cylinders	N/A
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quality	Batch/Lot # Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	56-021CRY1 30-Jun-2022

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 <sub>3</sub>	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

## Procedure Checklist

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

### 1. General:

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

### 2. PC Instrument Software:

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

### 3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary.
- ☒ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ☒ Clean exterior of the instrument.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's 80501018 & 80501250. 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.
- ☒ 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

### 4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ 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 900Z Series Pre-Installation Checklist SDB.
- ☒ Verify that the air filter element is dry. Replace if necessary.

### 7. After PM Performance tests [THGA]:

#### 7.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min $\pm$ 25 mL/min	255	Passed
External Flow Rate	100 mL/min $\pm$ 10 mL/min	104	Passed

#### 7.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	$\leq$ 0.005 Abs.	0.0007	Passed
Standard Deviation	$\leq$ 0.005	0.0002	Passed

#### 7.3 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 <sub>0</sub> Results	$\leq$ 7.0 pg/0.0044 A-s	6.3	Passed
Precision	$\leq$ 2.0 %	1.49	Passed



7.4 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 <sub>0</sub> Result	≤ 16.5 pg/0.0044 A-s	14.2	Passed
Zeeman Ratio	0.52 ± 0.04	0.52	Passed

8. Review:

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

Additional Comments

Additional Comments Regarding the PM	
Zeeman Ratio = $\frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$	
	0.1529
=	0.1529+0.1361
=	0.52

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.	
This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 28-Jun-2022 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 28-Jun-2022 (DD-MM-YYYY)



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

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

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

Cert.No.: 22CH6  
Page.: 1 of 2

## Certificate of Calibration

Equipment : Salinity Meter  
Manufacturer : AZ  
Model : AZ8371  
Serial No. : 298475  
ID No. : NO.1  
Condition As-Received: Used Item  
Received Date : 29 December 2021  
Calibration Date : 04 January 2022  
Reference : 2112-0752WN-3  
Submitted by : Environment Research & Technology Company Limited,  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210

Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(65 \pm 15) \%$   
Calibration Procedure: In - house method : based on direct measurement by  
using Sodium Chloride Solution

Calibrated by : Walalak Sirthean

Approved by :  Approved Signatory

( ) Malee Butkruea  
( ) Sathip Meangmai  
( ) Warakorn Lemgagrakul

Issue Date : 7 January 2022

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

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

A 0008190



Cert.No.: 22CH6  
Page.: 2 of 2

### Condition of this result of calibration

1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Thermometer	1963884	130RC114	21I978	17 Sep 2022
2) Thermo-Hygrograph	1103328	130EC010	21H1462	27 June 2022

2. Reference Standard Material :

- Conductivity calibrated solution, Eutech (traceable to NIST)
- Calibrated Total Dissolved Solids solution temperature controlled by Water bath at  $(25 \pm 0.1) ^\circ\text{C}$
- The Total Dissolved Solids has been prepared dilution from

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

Material	Manufacturer	Lot No.	Exp. Date
25 ppt	Eutech	230/01	07 June 2023

Calibration results : ( \* ) Adjustment at 2.84 ppt

Probe Serial No. : 298475

Standard	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
NaCl Solution				
2.84 ppt	2.49 ppt	2.83 ppt	0.030 ppt	2.00

Remark: - UUC\* = Unit Under Calibration  
- ppt = ppt of NaCl  
- ppt = Parts per Thousand

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-

a 1088744

Mettler-Toledo (Thailand) Ltd.  
84/4 - 84/5 Lualaba Rd., Bangna Sub-District  
Bangna District, Bangkok 10260  
+66 2723 0382  
MT-TH.ServiceSupport@mt.com



## Accuracy Calibration Certificate

### Customer

Company: ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.  
Address: 25/114 Moo 6, Soi Chinakut 1, Ngamwongwan Rd., Toongsongkhro  
City: Luks  
Zip / Postal: 10210  
State / Province: Bangkok  
Order Number: 

Contact: Ranita Traungthai

### Weighing Device

Manufacturer: Mettler Toledo  
Model: MS204S01  
Serial No.: B334931337  
Building: N/A  
Floor: 5  
Room: 504  
Instrument Type: Weighing Instrument  
Asset Number: ERTC-LIN-088  
Terminal Model: N/A  
Terminal Serial No.: N/A  
Terminal Asset No.: N/A

Range	Max. Capacity	Readability (g)
1	220 g	0.0001 g

### Procedure

Calibration Guideline:  
METTLER TOLEDO Work Instruction:  
EURAMET up-18 v. 4.0 (1/2015)  
CP7W00220  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.  
In accordance with EURAMET up-18 (1/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

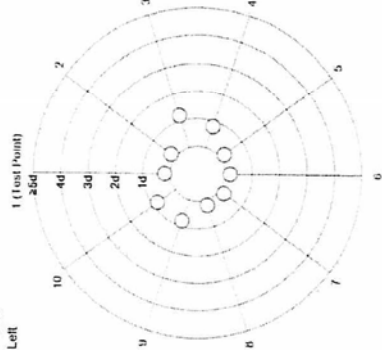
As Found	Start: 23.9 °C	End: 24.2 °C	Start: 45.8 %	End: 54.8 %
	Temperature		Humidity	

As Found Calibration Date: 19-Jan-2022  
As Left Calibration Date: N/A  
Issue Date: 20-Jan-2022  
Calibrator:   
Approved Signatory:   
Signature:   
Kissakorn Tassanachaisukul  
Santi Jitroyom  
Surachet Sukkato

## Measurement Results Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9998 g	N/A
2	99.9998 g	N/A
3	99.9997 g	N/A
4	99.9999 g	N/A
5	99.9998 g	N/A
6	99.9998 g	N/A
7	99.9998 g	N/A
8	99.9998 g	N/A
9	99.9999 g	N/A
10	99.9999 g	N/A
Standard Deviation	0.00006 g	N/A

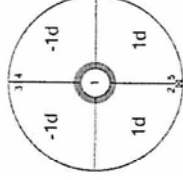


The "g" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

## Eccentricity

Test Load: 100 g

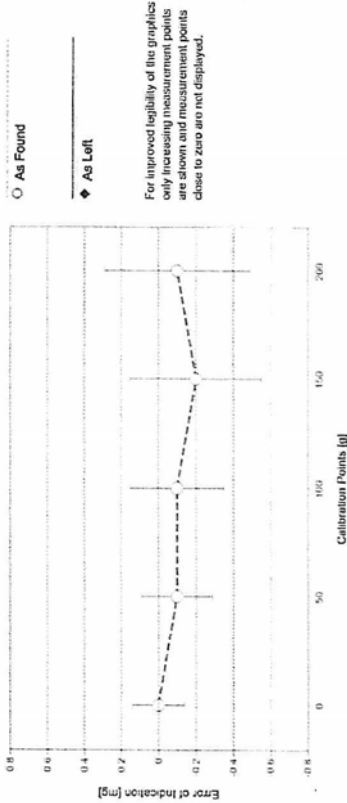
Position	As Found	As Left
1	99.9998 g	N/A
2	99.9999 g	N/A
3	99.9997 g	N/A
4	99.9997 g	N/A
5	99.9999 g	N/A
Maximum Deviation	0.0001 g	N/A



The "g" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.14 mg	2
2	0.05000 g	0.0500 g	0.0000 g	0.15 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.15 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.15 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.16 mg	2
8	50.0000 g	49.9999 g	-0.0001 g	0.19 mg	2
9	99.9999 g	99.9998 g	-0.0001 g	0.25 mg	2
10	149.9999 g	149.9997 g	-0.0002 g	0.35 mg	2
11	199.9999 g	199.9998 g	-0.0001 g	0.39 mg	2



This uncertainty stated in the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measured lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2			
Weight Set No.:	WG03	Date of Issue:	21-Sep-2021
Certificate Number:	175408	Calibration Due Date:	14-Mar-2023
Thermo Hygrometer			
Equipment No.:	IN281	Date of Issue:	25-May-2021
Certificate Number:	2111100	Calibration Due Date:	10-May-2022

Remarks

FACT adjustment functionally activated  
Equipment condition: Good  
Next calibration according to customer's procedure

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.



Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value  $R$  represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $1.5 \cdot 10^{-4} / K$   
Temperature range on site for the evaluation of the measurement uncertainty in use:  $4 K$

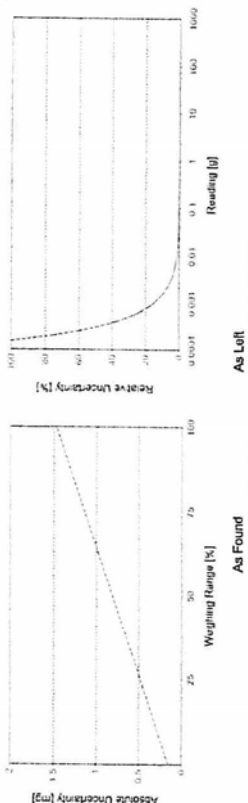
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1	0.0001 g	220 g	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Example)

Net Indication	As Found	As Left
0.0220 g	0.15 mg	0.68%
0.2200 g	0.15 mg	0.069%
2.2000 g	0.16 mg	0.0074%
22.0000 g	0.28 mg	0.0013%
220.0000 g	1.5 mg	0.00067%



# GWP® Certificate

As Found ✓

As Left ✓

The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ No adjustments/modifications made, As Left results correspond to As Found.

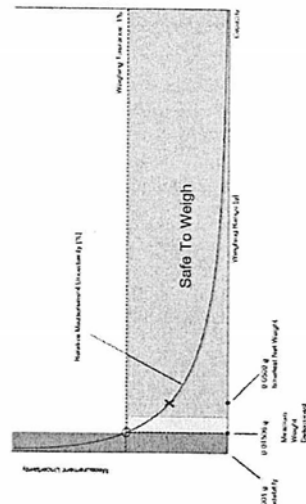
## Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

## Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. The graph reflects As Left results, unless only As Found was performed.



## Minimum Weight

As Found Minimum Weight Table

Tolerance	Minimum weights for different weighing tolerances and safety factors				
	1	2	3	5	10
0.1%	0.15140 g	0.30476 g	0.45993 g	0.77601 g	1.60147 g
0.2%	0.07550 g	0.15146 g	0.22788 g	0.38211 g	0.77601 g
0.5%	0.03015 g	0.06037 g	0.09066 g	0.15146 g	0.30476 g
1%	0.01508 g	0.03015 g	0.04525 g	0.07550 g	0.15146 g
2%	0.00753 g	0.01506 g	0.02260 g	0.03770 g	0.07550 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01508 g	0.03015 g

✓ Pass: The determined minimum weight meets the requirement for the smallest net weight.

## As Left Minimum Weight Table

Tolerance	Minimum weights for different weighing tolerances and safety factors				
	1	2	3	5	10
0.1%	0.15140 g	0.30476 g	0.45993 g	0.77601 g	1.60147 g
0.2%	0.07550 g	0.15146 g	0.22788 g	0.38211 g	0.77601 g
0.5%	0.03015 g	0.06037 g	0.09066 g	0.15146 g	0.30476 g
1%	0.01508 g	0.03015 g	0.04525 g	0.07550 g	0.15146 g
2%	0.00753 g	0.01506 g	0.02260 g	0.03770 g	0.07550 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01508 g	0.03015 g

✓ Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these not minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with  $k = 2$  and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

### Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

## Measurement Results

Results Summary

	Repeatability		Eccentricity	Error of Indication
	As Found	As Left		
✓ = Passed	✓	✓	✓	✓
✗ = Failed				
⚠ = Safety Factor not met				

### Repeatability

Test Load: 100 g

Tolerance	Control Limit		As Found		As Left	
			Std. Deviation	Result	Std. Deviation	Result
0.1%		N/A		N/A		N/A
0.2%		0.00005 g		✗		✗
0.5%		0.00013 g		✓		✓
1%		0.00025 g		✓	0.00006 g*	✓
2%		0.00050 g		✓		✓
5%		0.00125 g		✓		✓

\*The calculated standard deviation value is below the rounding error of the balance. The 0.41% rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

### Eccentricity

Test Load: 100 g

Tolerance	Control Limit		As Found		As Left	
			Deviation	Result	Deviation	Result
0.1%		0.0500 g		✓		✓
0.2%		0.1000 g		✓		✓
0.5%		0.2500 g		✓		✓
1%		0.5000 g	0.0001 g	✓	0.0001 g	✓
2%		1.0000 g		✓		✓
5%		2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

As Found

Service Date: 2022-01-19

Document Number: TH2085-105-011922-LABBalanceHR

ENVIRONMENT RESEARCH &amp; TECHNOLOGY CO., LTD

25/114 Moo 6, Soi Chulaket 1, Ngamwongwan Rd., Toongsongkro 11, Laksa, Bangkok 10210

Ramita Teenghual

## Balance Health Report

Device Details	
Manufacturer:	Mettler Toledo
Model:	MS204S
Serial number:	8134691317
Firmware:	1.74
Weight set for routine testing:	Yes /

History	
Device History	Service History
Instrument in use:	Yes
Instrument age:	> 10 years
Spare parts available:	Yes
Regulations:	ISO
Process tolerance in %:	1%
Smallest sample not weight:	0.05g
Routine testing performed:	Yes

Check List	
Environmental Conditions	General & Functional Checks
Room temperature fluctuation	Leveling
Exposure to direct sun	Cleanliness
Vibrations	Completeness - missing parts see additional remarks
Draft	Settings optimized for operating environment
Dirt or dust	Other - objections noted as additional remarks
Static	Electrical Component Checks
	Power supply
Draft shield	Sliding door drive
Weighing pan position	Internal weight drive
Housing	Display
Other - objections noted as additional remarks	Other - objections noted as additional remarks

Recommendations	
Measurement Result Quality	Process Efficiency
Instrument calibration	Uninstall instrument
Identify safe weighing range	Replace instrument
GWP verification / risk assessment	Replace / add parts (see additional remarks)
Preventive maintenance	Onsite repair
Perform routine testing with test weights	Deposit repair
User training	Use of accessories (see additional remarks)
Contact Name: Ramita Teenghual	Position: N/A
Phone: 086504459	Email: ramita@enviresearch.co.th
Date: 10-Jan-2022	Name: Sawicha Chayamchue
Signature:	

This is not a certificate.

It should not be used to interpret final results for the testing of these devices

L000035: ☒ GoodPass ☐ Needs Attention ☒ Bad/Fail ☐ Not Applicable

61641 - 8465 Leuahe Rd., Bangna Tai Sub District, Bangna District, Bangkok 10700, +66 2723 9192

M1-111 Service@enviresearch.net

Report Version: 1.13, 6/8/20

METTLER TOLEDO Service

METTLER TOLEDO



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9404



Cert. No.: 22TM152  
Page: 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UF 110  
Serial No. : B414.0652  
ID No. : ERTC-L-In.-098

Submitted by : Environment Research & Technology Company Limited  
25/114 Moo 6 Soi Chinakhet 1,  
Ngamwongwan Road, Toongsonghong, Lakse,  
Bangkok 10210  
Location : Laboratory (ERTC)

Received Order : 5 January 2022  
Calibration Date : 5 January 2022  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Man Paltanapongpaiboon

Approved by :   
Approved Signatory

( ) Ponnhippa Tameyakul  
( ) Malee Bulkruea  
( ) Suwit Imjai

Issue Date : 21 January 2022

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.



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2201-0006ON-3

### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44031769	21LM12	02 Sep 2022

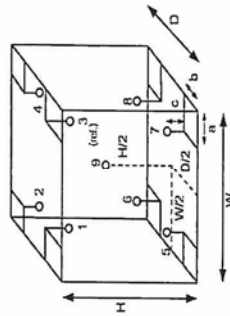
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration:- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



### Probe Installation Details :

Probe	Dimension of Chamber :
a = 5.0 cm	D = 0.40 m
b = 5.0 cm	W = 0.56 m
c = 5.0 cm	H = 0.48 m
	Capacity = 0.11 m <sup>3</sup>

Environment during calibration	
Beginning	Finished
Temp. ( °C )	27
REL.Humid. ( % )	54
AC Supply ( Volt )	219
	222

Ref. Std. ID No.: @	
Position :	Calibration Point
1	20-09TC-01
2	20-09TC-02
3	20-09TC-03
4	20-09TC-04
5	20-09TC-05
6	20-09TC-06
7	20-09TC-07
8	20-09TC-08
9 (ref.)	20-09TC-09

20-1-15

A 0036819

A 1090218





Equipment : Hot Air Oven  
Condition As-Received :  
Reference : 2201-0006ON-3  
Result of Calibration :-  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM152  
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.11	1.0	1.9	0.42	2
180.0	180.0	180.0	0.51	2.3	4.2	1.2	2

Calibration Point (°C)	Measured Temperature (°C)								
1	2	3	4	5	6	7	8	9 (ref.)	
104.0	105.219	103.394	103.908	104.133	104.348	104.096	103.878	104.103	104.360
180.0	182.291	178.691	178.879	180.031	180.761	180.026	180.572	180.044	180.253

Average\* : The average of 30 values in each position.  
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
UUC\* : Unit Under Calibration  
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9384



NSC-TIS-TIS7925  
CALIBRATION 0008

Cert. No.: 22TM151  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Hot Air Oven  
**Manufacturer :** Binder  
**Model :** FED 115 E2  
**Serial No. :** 11-22823  
**ID No. :** ERTC-L-In.-076  
**Submitted by :** Environment Research & Technology Company Limited  
25/114 Moo 6 Soi Chinaket 1,  
Ngamwongwan Road, Toongsonghong, Lakso,  
Bangkok 10210  
**Location :** Laboratory (ERTC)  
**Received Order :** 5 January 2022  
**Calibration Date :** 5 January 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Man Pattanapongpalboon  
**Approved by :**   
( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Injai

**Issue Date :** 21 January 2022  
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 3 : Equipment Calibration and Testing Services.



**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2201-0006ON-2  
**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44031769	21LM12	02 Sep 2022

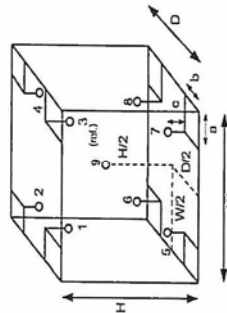
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

Environment during calibration	
Temp. ( °C )	Beginning Finished
REL.Humid. ( % )	27 27
AC Supply ( Volt )	54 58
	219 222



**Probe Installation Details :** Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.60 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.12 m³

Ref. Std. ID No.: @ Calibration Point	
Position :	( 180 ) °C ( 104 ) °C
1	20-09TC-01 9RTD-2/1
2	20-09TC-02 9RTD-2/2
3	20-09TC-03 9RTD-2/3
4	20-09TC-04 9RTD-2/4
5	20-09TC-05 9RTD-2/5
6	20-09TC-06 9RTD-2/6
7	20-09TC-07 9RTD-2/7
8	20-09TC-08 9RTD-2/8
9 (ref.)	20-09TC-09 9RTD-2/9





Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2201-0006ON-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM151  
Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
104	104	104	0.11	1.1	1.4	0.89	2
180	180	180	0.43	3.3	5.6	1.5	2

Measured Temperature ( °C )								
Position								
1	2	3	4	5	6	7	8	9 (ref.)
104	103.167	102.948	104.098	104.155	104.013	103.198	103.619	103.294
180	177.080	177.342	181.816	181.065	179.474	177.914	181.064	179.354
								178.751

Average\* : The average of 30 values in each position.  
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .  
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 %.

-000-