



ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือวิเคราะห์



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.: 22CH10
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Eutech
Model : pHTestr 30
Serial No. : 926524
ID No. : NO.1
Condition As-Received: Used Item
Received Date : 29 December 2021
Calibration Date : 04 January 2022
Reference : 2112-0752WN-7
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 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 :
(/) Malee Bulkruea
() Saitip Meangmai
() Warakorn Lernagtrakul
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.



Cert.No.: 22CH10
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

Buffer Solution	Manufacturer	Lot No.	Exp. date
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 (±)	Coverage factor k
pH Electrode	4.008	4.02	N/A	0.0071	2.00
S/N.: 926524	6.982	6.96	N/A	0.011	2.00
	10.015	10.01	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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Cert.No.: 22TW1
Page.: 2 of 2

Cert.No.: 22TW1
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro20i
Serial No. : 16D101088
ID No. : NO.7
Received Date : 29 December 2021
Test Date : 04 January 2022
Reference : 2112-0752WN-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 ± 5) °C
Humidity (50 ± 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
() Salthip Meangmai
() Warakorn Lernagatrakul

Issue Date : 7 January 2022

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 19C100843

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.12	0.0084

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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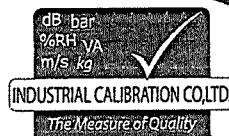
Industrial Calibration Co., Ltd.

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.CAL03002-22..... PAGE1..... OF2.....

Certificate of Calibration

Equipment : EC/ TDS/ TEMPERATURE METER

Manufacture : HM DIGITAL

Model / Type : COM-100

Serial No. : PONPE5851661

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 : MAR 1, 2022

Date Of Calibration : MAR 3, 2022

Calibration By : CHICHAWADEE CHANTAKHAD

Approved By :

(CHINNAWAT DUMPUT)

Date of Issue : MAR 3, 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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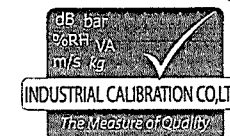
Industrial Calibration Co., Ltd.

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.CAL03002-22..... PAGE2..... OF2.....

Calibration Report

ORDER No. 2009-066

RECEIVED DATE : MAR 1, 2022

CALIBRATION DATE : MAR 3, 2022

DESCRIPTION:		MANUFACTURER:	
EC/ TDS/ TEMPERATURE METER		HM DIGITAL	
MODEL:	SERIAL No.	IDENTIFICATION No:	MADE IN :
COM-100	PONPE5851661	N/A	N/A
CALIBRATION METHOD :			
THIS INSTRUMENT WAS CALIBRATED BY COMPARISON WITH STANDARD BUFFER SOLUTION IN-HOUSE METHOD			
REFERENCE STANDARD :			
DESCRIPTION :	MODEL	S/N No.	CERTIFICATE No.
STANDARD BUFFER SOLUTION	ECCON1413BT	01X211207	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 μ S

RESOLUTION : 1 μ S

FUNTION : CONDUCTIVITY MEASUREMENT

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

REMARK : UUC* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -




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TEL. 0-2717-3000-27 FAX. 0-2719-9484



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 Chinaket 1,
Ngamwongwan Road, Toongsonghong, Laksi,
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 Pattanapongpaiboon

Approved by : 
Approved Signatory

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

Issue Date : 21 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.


24-1-65

A 0036819



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

Cert. No.: 22TM152
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) 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

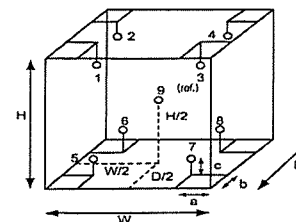
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 : 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 m³

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

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


24-1-65

a 1090218



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2201-0006ON-3
Result of Calibration :- (*) Without Adjustment

Cert. No.: 22TM152

Page.: 3 of 3

Function of UUC* : Temperature Source

Fresh air setting : Close

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>
104.0	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)								
	Position								
	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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26-1-65

Malu.

a 1090217

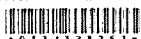
Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tui Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: ENVIRONMENT RESEARCH&TECHNOLOGY CO., LTD.
Address: 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghro
City: Laksi Contact: Ramita Taengthai
Zip / Postal: 10210
State / Province: Bangkok
Order Number:



Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: MS204S/01 Asset Number: ERTC-L-IN-088
Serial No.: B334691537 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 5 Terminal Asset No.: N/A
Room: 504

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20

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 cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

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

As Found Calibration Date: 19-Jan-2022
As Left Calibration Date: N/A
Issue Date: 20-Jan-2022

Calibrator:

Suwicha C.
Suwicha Choykarnchu

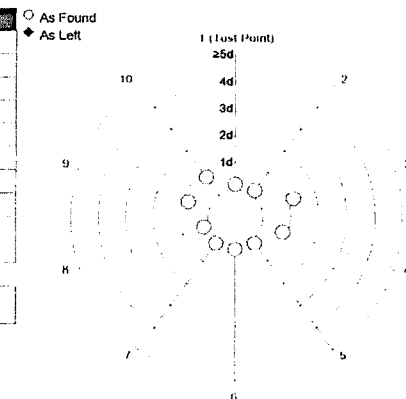
Approved Signatory:

Kasakorn Tassanachaisakul
☒ Kasakorn Tassanachaisakul
☐ Santi Jitniyom
☐ Surachet Sukkate

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

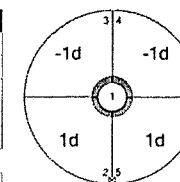


The "d" in the graph represents the readability of the range/interval in which the test was performed.

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



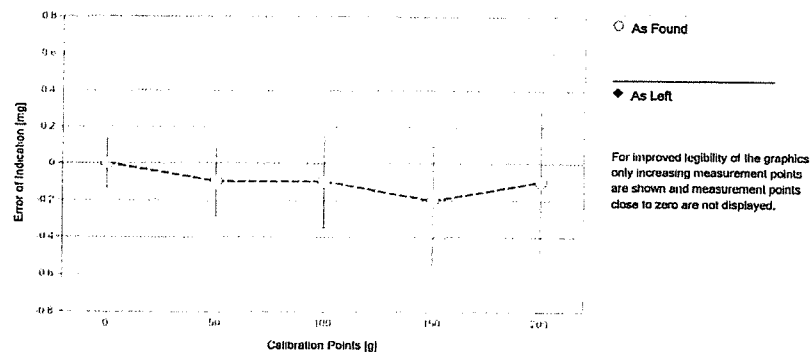
As Found

The "d" 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	0.0500 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



The uncertainty stated is 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 measurand 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.: WS03 Date of Issue: 21-Sep-2021
Certificate Number: 175498 Calibration Due Date: 14-Mar-2023

Thermo Hygrometer

Equipment No.: IN281 Date of Issue: 25-May-2021
Certificate Number: 21H1100 Calibration Due Date: 10-May-2022

Remarks

FACT adjustment functionality 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: $1.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 4 K

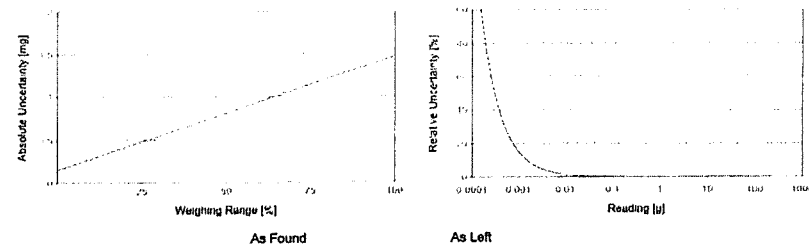
Linearization of Uncertainty Equation

Range	As Found		As Left
	d	Max	
1	0.0001 g	220 g	$U_1 = 0.15 \text{ mg} + 0.00599 \text{ mg/g} \cdot R$
			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 (Examples)

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



GWP® Certificate



As
Found



As
Left



The weighing device meets the given process requirements.

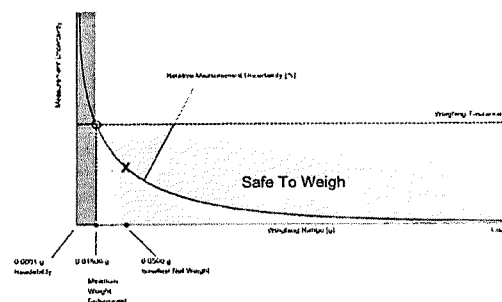
The weighing device meets the given process requirements.

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. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15146 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%	0.01506 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	0.01506 g	0.03015 g

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

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15146 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	0.01506 g	0.03015 g

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

At these net 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

N/A = 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	0.00006 g*	✓	0.00006 g*	✓
1%	0.00025 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*d 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	0.0001 g	✓	0.0001 g	✓
1%	0.5000 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.

Attachment to Calibration Certificate:

TH2065-083-011922-ACC-TH

GWP® Certificate

Error of Indication

METTLER TOLEDO Service

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	-0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	-0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	-0.0002 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9999 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	-0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	-0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	-0.0002 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9999 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

Service Date: 2022-01-19

Document Number: TH2065-165-011922-LABBalanceHR

ENVIRONMENT RESEARCH&TECHNOLOGY CO., LTD

25/114 Moo 6, Soi Chinkat 1, Ngamwongwan Rd., Toongsongho น.จ.นนทบุรี, Lakki, Bangkok 10210

Ramita Taengthai

METTLER TOLEDO

Balance Health Report

Device Details

System Details			
Manufacturer:	Mettler Toledo	Accessory 1:	
Model:	MS204S	Accessory 2:	
Serial number:	B334691537	Weight set for routine testing:	Yes /
Firmware:	1.74		

History

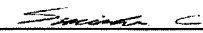
Device History		Service History	
Instrument in use:	Yes	Last preventive maintenance:	< 1 year
Instrument age:	> 10 years	Last instrument calibration:	< 1 year
Spare parts available:	Yes	Last minimum weight determination:	
Regulations:	ISO		
Process tolerance in %:	1%	Routine testing performed:	Yes
Smallest sample net weight:	0.05g		

Check List

Environmental Conditions		General & Functional Checks	
Room temperature fluctuation	✓	Levelling	✓
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	
Mechanical 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		Depot repair	
User training		Use of accessories (see additional remarks)	

Contact	Name: Ramita Taengthai	Position: N/A	Phone: 0868334490	Email: ramita@enviresearch.co.th
Additional Remarks & Recommendations				Engineer Details
				Date: 19-Jan-2022
				Name: Suwicha Choykamchu
				Signature: 

This is not a certificate.

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

Legend:

✓ Good/Pass

⚠ Needs Attention

✗ Bad/Fail

— Not Applicable

Software Version: 1.23.0.229

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Page 4 of 4

Report Version: 2.10.8

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Form Number: F103C

26-1-65

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MT-TM ServiceSupport@mt.com
www.mt.com

METTLER TOLEDO Service

Report Version: 1.13, Software Version 4.26.2.18, Page: 1/1, © METTLER TOLEDO

26-1-65

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
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MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: ENVIRONMENT RESEARCH&TECHNOLOGY CO., LTD.
Address: 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsongho
City: Laksi Contact: Ramita Taengthai
Zip / Postal: 10210
State / Province: Bangkok
Order Number:



Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: MS204TS00 Asset Number: ERTC-L4N-114
Serial No.: B547728937 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 5 Terminal Asset No.: N/A
Room: 504

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20

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 cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Start: 23.8 °C	End: 24.5 °C	Start: 49.7 %	End: 55.1 %
----------	----------------	--------------	---------------	-------------

As Found Calibration Date: 19-Jan-2022 Calibrator:
As Left Calibration Date: N/A
Issue Date: 20-Jan-2022

Approved Signatory:

Suwicha C
Suwicha Choykamchu
Kassakorn Tassanachaisakul
☒ Kassakorn Tassanachaisakul
☐ Santi Jitniyom
☐ Surachet Sukkate

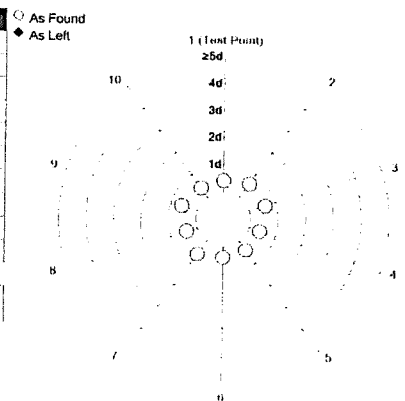
Measurement Results

Repeatability

Test Load: 100 g

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

Standard Deviation	0.00005 g	N/A
--------------------	-----------	-----



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

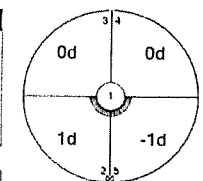
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

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

Maximum Deviation	0.0001 g	N/A
-------------------	----------	-----



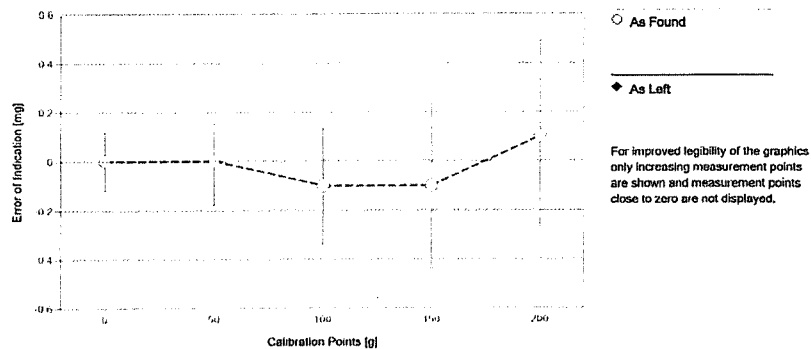
As Found

The "d" 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	0.12 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.13 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.13 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.13 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.14 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.14 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.18 mg	2
9	99.9999 g	99.9998 g	-0.0001 g	0.24 mg	2
10	149.9999 g	149.9998 g	-0.0001 g	0.34 mg	2
11	199.9999 g	200.0000 g	0.0001 g	0.39 mg	2



The uncertainty stated is 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 measurand 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.: WS03 Date of Issue: 21-Sep-2021
Certificate Number: 175498 Calibration Due Date: 14-Mar-2023

Thermo Hygrometer

Equipment No.: IN281 Date of Issue: 25-May-2021
Certificate Number: 21H1100 Calibration Due Date: 10-May-2022

Remarks

FACT adjustment functionality 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: $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 4 K

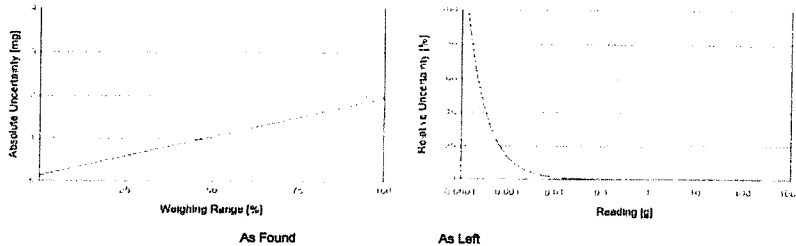
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00828 \text{ mg/g} \cdot R$	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 (Examples)

Net Indication	As Found			As Left	
0.0220 g	0.13 mg	0.59%		N/A	N/A
0.2200 g	0.13 mg	0.060%		N/A	N/A
2.2000 g	0.15 mg	0.0067%		N/A	N/A
22.0000 g	0.31 mg	0.0014%		N/A	N/A
220.0000 g	2.0 mg	0.00089%		N/A	N/A



GWP® Certificate



As Found



As Left



The weighing device meets the given process requirements.

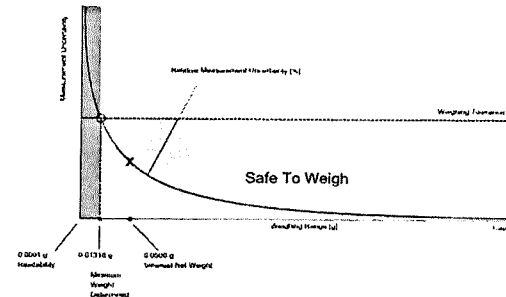
The weighing device meets the given process requirements.

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. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13276 g	0.26775 g	0.40503 g	0.68670 g	1.43539 g
0.2%	0.06610 g	0.13276 g	0.19997 g	0.33610 g	0.68670 g
0.5%	0.02637 g	0.05284 g	0.07939 g	0.13276 g	0.26775 g
1%	0.01318 g	0.02637 g	0.03960 g	0.06610 g	0.13276 g
2%	0.00659 g	0.01318 g	0.01977 g	0.03298 g	0.06610 g
5%	0.00263 g	0.00527 g	0.00790 g	0.01318 g	0.02637 g

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

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13276 g	0.26775 g	0.40503 g	0.68670 g	1.43539 g
0.2%	0.06610 g	0.13276 g	0.19997 g	0.33610 g	0.68670 g
0.5%	0.02637 g	0.05284 g	0.07939 g	0.13276 g	0.26775 g
1%	0.01318 g	0.02637 g	0.03960 g	0.06610 g	0.13276 g
2%	0.00659 g	0.01318 g	0.01977 g	0.03298 g	0.06610 g
5%	0.00263 g	0.00527 g	0.00790 g	0.01318 g	0.02637 g

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

At these net 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

Δ = 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	0.00005 g*	✓	0.00005 g*	✓
1%	0.00025 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*d 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	0.0001 g	✓	0.0001 g	✓
1%	0.5000 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.

Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	-0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	-0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9999 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	-0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	-0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9999 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

Service Date: 2022-01-19
Document Number: TH2065-164-011922-LABBalancoHR
ENVIRONMENT RESEARCH&TECHNOLOGY CO., LTD
25/114 Moo 6, Soi Chinakhet 1, Ngamwongwan Rd., Toongsongho n.angwongwan, Laksi, Bangkok 10210
Ramita Taengthai

Balance Health Report

Device Details

System Details			
Manufacturer:	Mettler Toledo	Accessory 1:	
Model:	MS204TS	Accessory 2:	
Serial number:	8547728937	Weight set for routine testing:	Yes /
Firmware:	3.50		

History

Device History		Service History	
Instrument in use:	Yes	Last preventive maintenance:	< 1 year
Instrument age:	3-10 years	Last instrument calibration:	< 1 year
Spare parts available:	Yes	Last minimum weight determination:	< 1 year
Regulations:	ISO		
Process tolerance in %:	1%	Routine testing performed:	Yes
Smallest sample net weight:	0.0500 g		

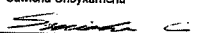
Check List

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	✓		
Mechanical Component Checks		Electrical Component Checks	
Draft shield	✓	Power supply	✓
Weighing pan position	✓	Sliding door drive	✓
Housing	✓	Internal weight drive	✓
Other - objections noted as additional remarks	—	Display	✓
		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		Depot repair	
User training		Use of accessories (see additional remarks)	

Contact: Name: Ramita Taengthai Position: N/A Phone: 0866334490 Email: ramita@enviresearch.co.th

Additional Remarks & Recommendations		Engineer Details	
		Date:	19-Jan-2022
		Name:	Suwicha Choykamchu
		Signature:	

This is not a certificate.

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

Legend: ✓ Good/Pass ⚠ Needs Attention ✗ Bad/Fail — Not Applicable

26-1-65

26-1-65



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Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Service Confirmation Number: 6903908836

Service Confirmation Date: 18.11.2021

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

SERVICE REPORT

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

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.,
Krungthonburi Road, Banglamphu-Lang
Klong San
BANGKOK 10600

Delivery Site:

Environment Research & Technology
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Ngamwongwan Rd
25/114 Moo 6 Soi Chinnakhet 1

Location:

Room
Bldg
Lab
Dept

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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:

products applications software services

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968 Rama 4 Road, Silom, Bangrak,
Bangkok 10500 Thailand
Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey New
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama 1 Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6903908836

Service Confirmation Date: 18.11.2021

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Agilent CrossLab Compliance Services

Service Information:

Problem Description:
T-WM-S-PMOQ-ID5100-5000961745

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 Sompanithan

Customer Field Service
Representative Signature:

Date:
18 Nov 2021

Customer Name:
RAIWIN POSIT

Customer Signature:

Date:
18 Nov 2021

Additional Comments:



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	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 Sukpathrajaree
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
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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

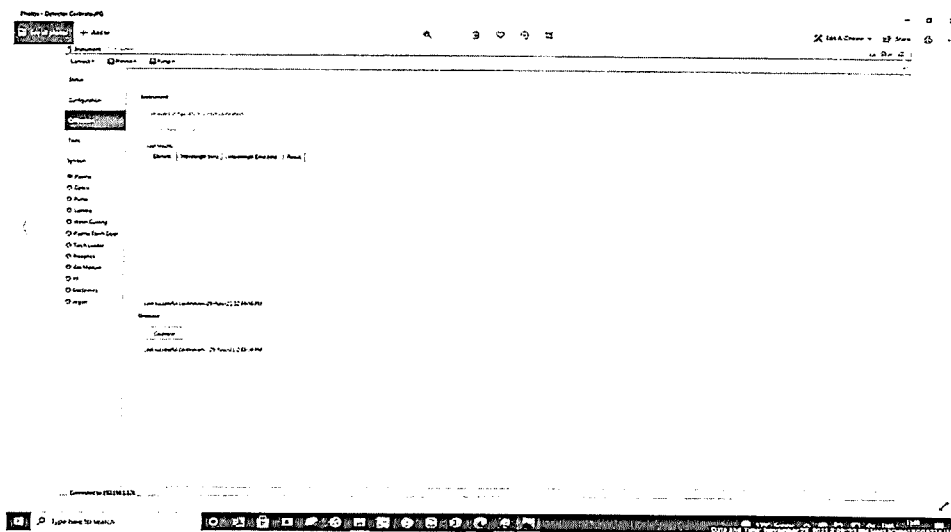
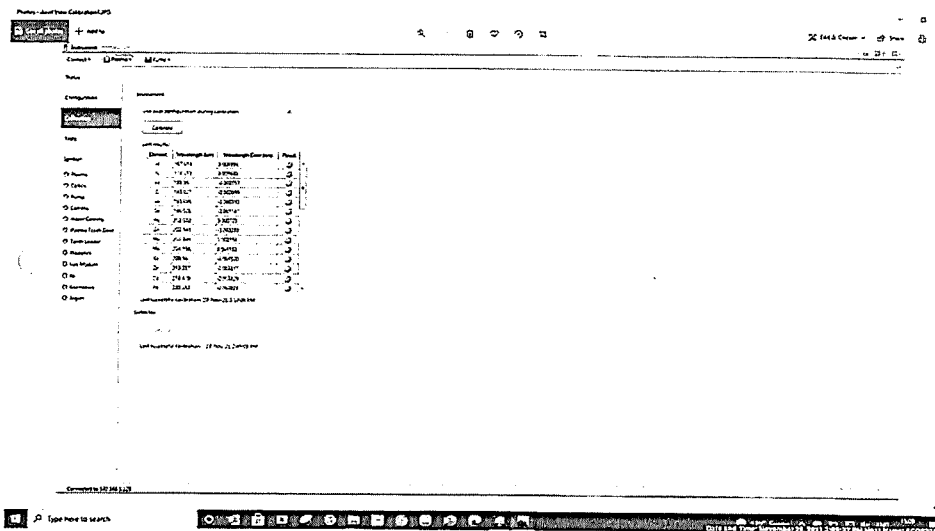


Image Details: Was the instrument calibration performed and completed successfully?

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

Host Name: 5CG9231J5L



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	Yes	Yes	Pass
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

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 #: 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

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

General

Document Name: Certificate of Qualification for ACE



Certificate of Completion

Learner Name: Kanyakorn Sukpathrajareem

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.

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

General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name: Kanyakorn Sukpathrajareem

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



Certificate of Completion

Learner Name: Kanyakorn Sukpathrajareem

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: 610030100
Lot No: 001088002

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO ₃) ₃	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 ₄) ₂ MoO ₄	13105-75-8	5.001 ± 0.025 mg/L
Ba	Ba(NO ₃) ₂	10022-31-8	4.999 ± 0.025 mg/L	Hf	Hf	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 ₃) ₃	13549-39-4	5.001 ± 0.025 mg/L	Sr	Sr(NO ₃) ₂	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 ₃	7757-79-1	50.00 ± 0.25 mg/L				

Matrix: 5% HNO₃


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 (HNO₃) 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, 3138, 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.

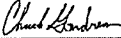
Instructions for Use: Agilent recommends that the solution be thoroughly mixed by repeated shaking or swirling of the bottle immediately prior to use. To achieve the highest accuracy the analyst should: (1) use only pre-cleaned containers and transferware, (2) avoid pipetting directly from the CRM's 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.

Page 1 of 3

Document Name: Certificate of Analysis Wavelength calibration solution



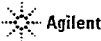
Period of Validity: Agilent ensures the accuracy of this solution until the expiration date shown below, provided the instructions for use are followed. During the period of validity, the purchaser will be notified if this product is recalled due to any significant changes in the stability of the solution.

Sample lot approval:

Chuck Coudreau, Certifying Officer

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

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.

Homogeneity: This solution was determined to be homogeneous by procedures consistent with the requirements of ISO 17024 and ISO Guide 35. Replicate samples of the finished solution were analyzed to confirm its homogeneity, in accordance with OSP 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 Certification: This CRM was prepared under a quality management system that is:

- Registered to ISO 9001 – Quality Management Systems – Requirements (TUV NORD Cert. No. 44 100 16560231)
- Accredited to ISO 17034 – General Requirements for the Competence of Reference Material Producers (AZLA Cert. No. 2848.B2)
 - 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 (AZLA Cert. No. 2848.B1)
- LSC Blvd#16, 270 Abby Road, Manchester, M19 6EJ

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		
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)	≤ 38.00	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

Document Name: Instrument's Test Report

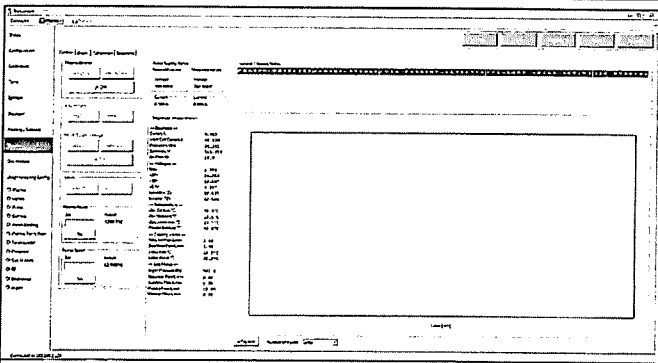
Sensitivity Test			Pass		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	122.4	1199.1	83.2
Se (196.026 nm)	≥ 41.0	SRBR	79.1	935.2	109.1
Zn (213.857 nm)	≥ 1421.0	SRBR	3206.2	52338.5	263.8
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2838.4	233.0
Mn (257.610 nm)	≥ 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)	≥ 10825.0	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

Document Name: Instrument's Test Report

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 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 (188.980 nm)	≤ 1.50	0.68	
Se (196.026 nm)	≤ 1.50	0.64	
Zn (206.200 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	

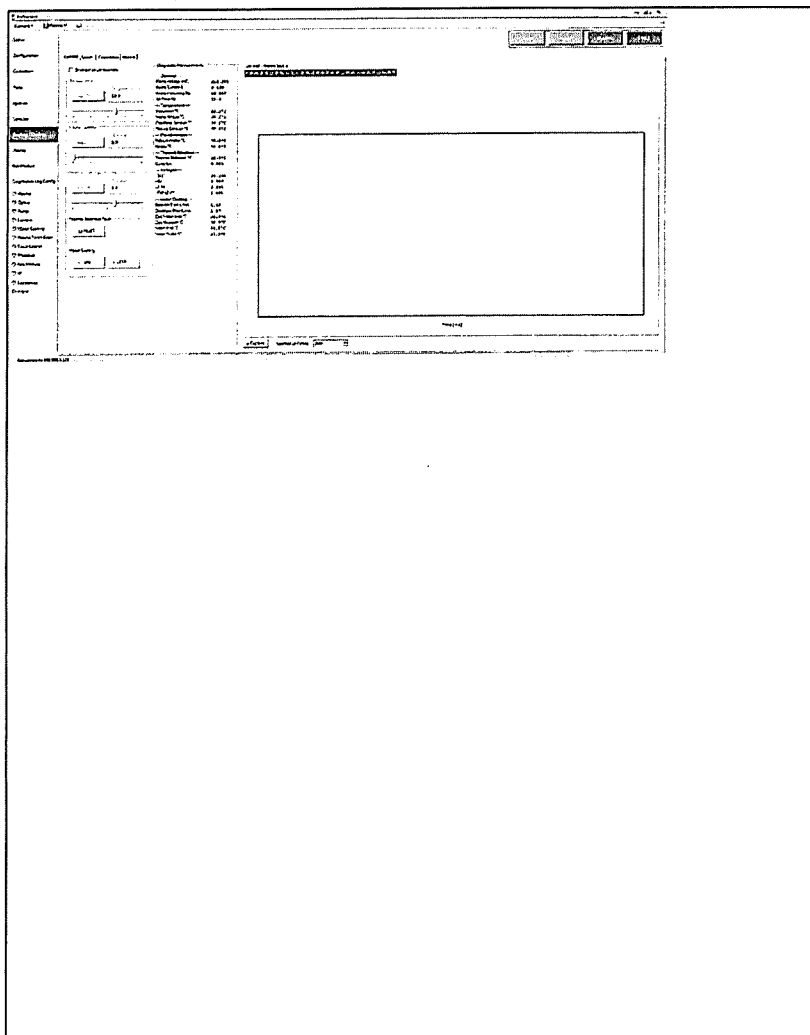
General

Document Name: Instrument's Test Report



General

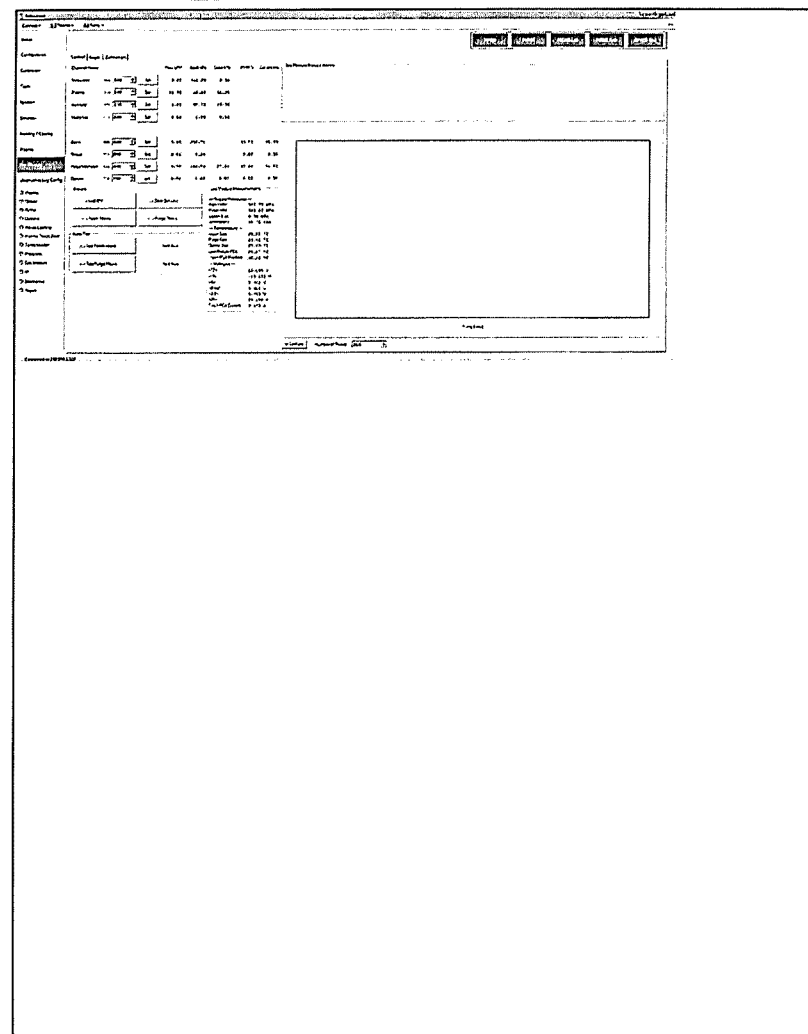
Document Name: Instrument's Test Report



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

General

Document Name: Instrument's Test Report

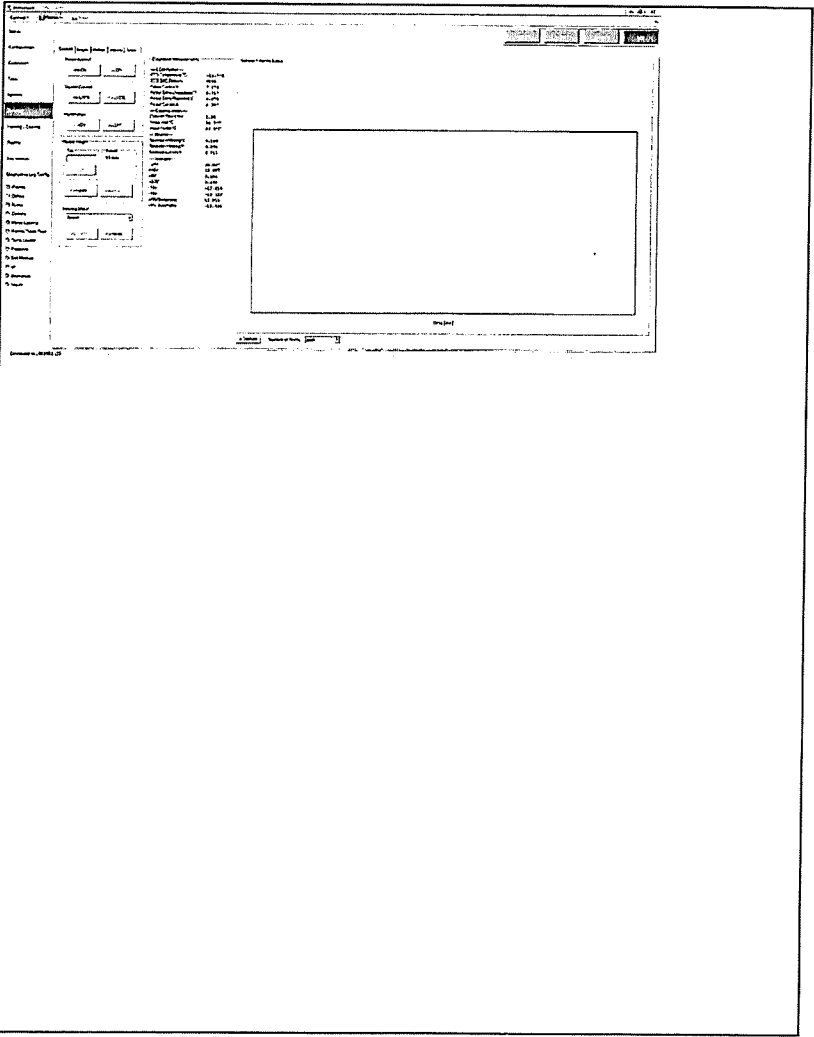


Date: November 29, 2021 3:20:41 PM
System ID: MY15330001

General

Document Name:

Instrument's Test Report





CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, 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 & Technogy 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 ± 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

This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service Co., Ltd.

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



PAGE 1/3

15-1-65



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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	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

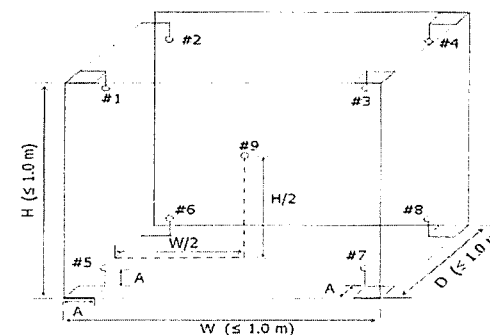


Diagram of Chamber

15-1-65 PAGE 2/3



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

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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

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%.

-END-

15-1-63 PAGE 3/3



Inctech Metrological Center Co.Ltd.
39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,
Saimai, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



ACCREDITED
Calibration Cert. # 3884.01
ISO/IEC 17025



Inctech Metrological Center Co.Ltd.
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ACCREDITED
Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate No. : MT22-1359
Page : 2 of 4

Certificate of Calibration

Certificate No. : MT22-1359
Page : 1 of 4

Customer : Environment Research & Technology Co.,Ltd.
Address : 25/114 M.6 Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong, Laksi Bangkok 10210

Description : Heating Block
Manufacturer : Hanna
Model : HI 839800-02
Serial No. : 05220025101
Identification No. : ERTC-L-In-165
Calibration Place : Temperature Laboratory

Order No. : 0149/22
Received date : Jan 14, 2022
Calibration date : Jan 18, 2022
Environment Condition :
Temperature : (23+/-3) °C
Humidity : (50+/-15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure CP-MT-009 According to comparison with LXI Data Acquisition Switch Unit.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with RTD Sensor	34972A	MY57003222	MT21-5866	Oct 11, 2022

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

Traceability : This measurement are traceable to the International System of Unit (SI), through
National Institute of Metrology Thailand (NIMT)

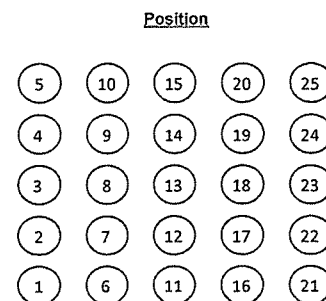
The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor $k = 2$,
providing a level of confidence of not less than 95%



Calibrated by : Miss Jarunee Tubsay
Issue date : Jan 18, 2022

Approved by :
(Mr. Panuwat Phuklan)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd



Top view

Function : Temperature measurement (Cont.)
Calibration point : 105, 150 °C
Immersion depth : 50 mm.

Result : Without adjustment

Position No.	UUC* setting (°C)	Standard reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
1	105	104.622	-0.378	0.17
2	105	104.536	-0.464	0.17
3	105	104.661	-0.339	0.17
4	105	104.742	-0.258	0.17
5	105	104.488	-0.512	0.17
6	105	104.392	-0.608	0.17
7	105	104.551	-0.449	0.17
8	105	104.532	-0.468	0.17
9	105	104.448	-0.552	0.17
10	105	104.395	-0.605	0.17
11	105	104.530	-0.470	0.17
12	105	104.648	-0.352	0.17
13	105	105.110	0.110	0.17
14	105	105.241	0.241	0.17
15	105	105.109	0.109	0.17

UUC* = Unit under calibration



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Certificate No. : MT22-1359

Page : 3 of 4

Function : Temperature measurement
Calibration point : 105, 150 °C
Immersion depth : 50 mm.

Result : Without adjustment

Position No.	UUC* setting (°C)	Standard reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
16	105	104.521	-0.479	0.17
17	105	104.633	-0.367	0.17
18	105	105.114	0.114	0.17
19	105	105.228	0.228	0.17
20	105	104.821	-0.179	0.17
21	105	104.648	-0.352	0.17
22	105	104.652	-0.348	0.17
23	105	104.533	-0.467	0.17
24	105	104.482	-0.518	0.17
25	105	104.421	-0.579	0.17

Function : Temperature measurement (Cont.)
Calibration point : 105, 150 °C
Immersion depth : 50 mm.

Result : Without adjustment

Position No.	UUC* setting (°C)	Standard reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
1	150	149.354	-0.646	0.17
2	150	149.542	-0.458	0.17
3	150	149.368	-0.632	0.17
4	150	149.554	-0.446	0.17
5	150	149.635	-0.365	0.17
6	150	149.582	-0.418	0.17
7	150	149.688	-0.312	0.17
8	150	149.624	-0.376	0.17
9	150	149.522	-0.478	0.17
10	150	149.501	-0.499	0.17
11	150	150.114	0.114	0.17
12	150	150.201	0.201	0.17
13	150	150.118	0.118	0.17
14	150	150.109	0.109	0.17
15	150	150.111	0.111	0.17

UUC* = Unit under calibration



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Certificate No. : MT22-1359

Page : 4 of 4

Function : Temperature measurement
Calibration point : 105, 150 °C
Immersion depth : 50 mm.

Result : Without adjustment

Position No.	UUC* setting (°C)	Standard reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
16	150	149.902	-0.098	0.17
17	150	149.745	-0.255	0.17
18	150	149.702	-0.298	0.17
19	150	149.828	-0.172	0.17
20	150	149.741	-0.259	0.17
21	150	149.822	-0.178	0.17
22	150	149.836	-0.164	0.17
23	150	149.878	-0.122	0.17
24	150	149.802	-0.198	0.17
25	150	149.798	-0.202	0.17

UUC* = Unit under calibration

Preventive Maintenance Kjeldahl

Service No. PM22-S08-072

1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท เอินไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซ.ชินเขต 1 ถ.งามวงศ์วาน พังสองห้อง หลักสี่ กรุงเทพมหานคร 10210 ติดต่อ: คุณจรรวณ Tel: 080-075 1451 Fax: -	K - 355	1000142231	22-Jun-2022 PM_1/1

2. Instrument

2.1 Cooling water (if it connected)	OK	NOT OK	Remark
- Temperature 15 – 20 °C	/		CTL-911
- Cooling water inlet	/		
- Cooling water outlet	/		
- Control Temperature	/		Set temp 15 C

2.2 Cleaning	DONE	NOT DONE	Remark
- Outside Instrument	/		
- Inside Instrument	/		
- Splash protector	/		
- Condenser	/		


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Preventive Maintenance Kjeldahl

2.3 Visual Test	OK	NOT OK	Remark
- Screw Coupling (between splash protector and condenser)	/		
- Condenser	/		
- Splash protector		/	เริ่มเสื่อมสภาพ
- Hypalon connection (connection tube)		/	เริ่มเสื่อมสภาพ
- Rubber bung		/	เริ่มเสื่อมสภาพ
- Ventilation valve	/		
- PTFE tube	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Magnetic valve	/		

2.4 System control	OK	NOT OK	Remark
- Key board	/		
- Display	/		
- Program	/		
- Adding H ₂ O	/		Reagent 1
- Adding NaOH	/		Reagent 2
- Adding H ₃ BO ₃	-		Do not have
- Aspiration	-		Do not have


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Preventive Maintenance Kjeldahl

3. Function Test

Addition H ₂ O	0 ml	Reaction time	0 min
Addition NaOH	0 ml	Distillation time	5 min
Addition H ₃ BO ₃	0 ml	Steam capacity	100%
		Aspiration	SAM

Result: Water in receiving vessel now approximately 170 ml, 171 ml

4. Summary



All specifications OK	Specification not OK
OK	

Comments

- Preventive Maintenance + Performance test 1/1
- Change part the Hose chemicals supply(043185) 1 pcs.
- TEST Run เครื่องทำงานปกติ

Signature BUCHI

- Service by Keen Date 16 - Jun - 2022

- Approve by Suphan C. Date 20 - Jun - 2022



Buchi (Thailand) Limited

Preventive Maintenance Block Digestion

Service No. PM22-S08-072

1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซ.ชินเขต 1 ถ.งามวงศ์วาน พังสองห้อง หลักสี่ กรุงเทพมหานคร 10210 ติดต่อ: คุณจารุวรรณ Tel: 080-075 1451 Fax: -	K- 449	1000299283	16-Jun-2022 PM_1/1



2. Instrument

	OK	NOT OK	Remark
2.1 Housing			
- Clean the housing	/		
- Visual check	/		
- Check for defects (e.g. cracks)	/		

	OK	NOT OK	Remark
2.2 Heating			
- Clean aluminum block	/		
- Visual check	/		
- Check heating element	/		



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Preventive Maintenance Block Digestion

2.3 Visual Check	OK	NOT OK	Remark
- Connection to suction	/		
- PTFE seal	/		
- O-ring	/		
- Glass holder set	/		
- Suction module	/		

2.4 Function test (This test does not use digestion vessels!)

- Select and store in .Program 9 by following parameters:
 - **Step 1** Ramp 1 Temp. 55°C Time 2 min.
 - **Step 2** Ramp 2 Temp. 70°C Time 2 min.
 - **Step 3** Ramp 3 Temp. 85°C Time 2 min.
 - **Step 4** Ramp 4 Temp. 100°C Time 2 min.
 - **Step 5** Cool Time 10 min.
- Check following functions:
 - Press key "Start": Start Time 00.00
 - 0 min. press key .Start. again starts heating from room temperature (LED Heating on)
 - 5 min. reaches 55°C (LED off) Lift goes down (K-438 only)
 - 6 min. starts heating again (LED on)
 - 7 min. reaches 70°C (LED off)
 - 8 min. starts heating again (LED on)
 - 9 min. reaches 85°C (LED off)
 - 10 min. starts heating again (LED on)
 - 11 min. reaches 100°C (LED off)
 - 12 min. starts cooling (fan on) Lift goes up (K-438 only)
 - 22 min. End / Scrubber off; LED still flashing displays 'power off delay - cooling' (Instrument will switch off automatically, if temperature of the heating block drops below 60°C)
- **Note:**
 - This are only approximate times starting from room temperature and they can vary slightly!
 - Not all heating positions have exactly the same heating output! (Constructive matter)
 - Temperatures may overshoot set temperatures. (only below 100°C)

Function test

☒ OK ☐ NOT OK



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Preventive Maintenance Block Digestion

2.5 System control	OK	NOT OK	Remark
- Keyboard	/		
- Display	/		
- Program	/		

3. Summary

All specifications OK	Specification not OK
OK	

Comments

- Preventive Maintenance + Performance test_1/1
- Change part the set Pt1000 temp. sensor(1106773) 1 pcs.
- TEST Run เครื่องทำงานปกติ

Signature BUCHI

- Service by keew Date 16 - Jun - 2022

- Approve by Supaphan C. Date 20 - Jun - 2022



Buchi (Thailand) Limited

Preventive Maintenance Kjeldahl

2.5 System Distillation	OK	NOT OK	Remark
- Boiler	/		6.9 A
- Water level sensor	/		
- One way valve	/		
- Pressure switch	/		
- Thermostat	/		
- Steam valve1 (Y4)	/		
- Steam valve2 (Y5)	-		Do not have
- Drain valve (Y3)	-		Do not have
- Water 3/2 way valve (Y1)	-		Do not have

2.6 Hose	OK	NOT OK	Remark
- Unisil hose	/		
- Hypalon hose	/		
- Drain hose	-		Do not have
- Viton hose	/		
- Silicone hose	-		Do not have

2.7 Diaphragm pump	OK	NOT OK	Remark
- Diaphragm pump for H ₂ O	/		
- Diaphragm pump for NaOH	/		
- Diaphragm pump for H ₃ BO ₃	-		Do not have

2.8 Program test	OK	NOT OK	Remark
- Distillation	-		Do not have
- Aspiration	-		Do not have
- Preheating	-		Do not have
- Cleaning	-		Do not have

Preventive Maintenance Scrubber

Service No. PM22-S08-072

1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซ.ชินเขต 1 ถ.งามวงศ์วาน ทั้งสองห้อง หลักสี่ กรุงเทพมหานคร 10210 ติดต่อ: คุณจาวรรณ Tel: 080-075 1451 Fax: -	B - 414	0700002874	16-Jun-2022 PM_1/1

2. Instrument

2.1 Cooling water (if it connected)	OK	NOT OK	Remark
- Temperature 10 – 20 °C	/		CTL-901
- Cooling water inlet	/		
- Cooling water outlet	/		Set temp 15 C

2.2 Cleaning	DONE	NOT DONE	Remark
- Housing	/		
- Condenser	/		
- Swirl disc	/		

Preventive Maintenance Scrubber

2.3 Visual Check

	OK	NOT OK	Remark
- Hose connection to suction	/		
- Glassware	/		
- Lip gasket	/		
- GL-14 connector	/		
- Activated charcoal	/		

2.4 Flush Pump

Make sure, the bypass valve is closed completely (for maximum suction power).

- Disconnect the silencer, move it down (or take it away from the instrument), and flush out the pump with at least 500 mL of distilled water through the pump inlet, until the collected washing water is clean.
- Switch on the instrument and collect the waste water from the pump output in a suitable vessel.

Flush pump

☒ OK

☐ NOT OK

2.5 Washing Solution

- Sodium hydroxide 8-10 %, max. 20 %
- Sodium carbonate
 - dissolve 600 g Na₂CO₃ in 3 L distilled warm water, or
 - dissolve 1.7 kg Na₂CO₃ in 10 H₂O in 3 L distilled warm water

Washing solution

☒ OK

☐ NOT OK

Preventive Maintenance Scrubber

3. Summary

All specifications OK	Specification not OK
OK	

Comments

- Preventive Maintenance + Performance test_1/1
- TEST Run เครื่องทำงานปกติ

Signature BUCHI

- Service by Keen Date 16 - Jun - 2022

- Approve by Suphan C. Date 20 - Jun - 2022

Performance Test

Service No. PM22-S08-072

1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท เ็นไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซอยชินเขต 1 ถนนงามวงศ์วาน แขวงทุ่งสอง ห้อง เขตหลักสี่ กรุงเทพมหานคร 10210 Tel: 02-954-7745 Fax:	K-355 K-449 B-414	1000142231 1000299283 0700002874	16 June 2022 (PM1/1)

2. Methods and Reagents

Digestion (assay 100.1%)	
Standard Substance:	Glycine
Theoretical %N content	18.618%
Catalyst	Mixed catalyst 10 g
Sulfuric acid	20 ml
Heating Level or Temp	420 องศา
Digestion time	90 min
Cooling time	30 min

Distillation and Titration (assay 100.2%)	
Standard Substance	Ammonium Sulfate
Theoretical %N content	21.24%
Titration method	Boric acid
Distilled water	50 ml
NaOH 32 %	90 ml
Boric acid 2 %	60 ml
Titration	0.5 N H ₂ SO ₄


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Performance Test

3. Results

No.	Sample	Sample Weight (g)	Volume of titrant (ml)	Nitrogen (%)	Recovery Rate (%)
1	Blank	-	0.05		
2	Blank	-	0.05		
3	Ammonium Sulfate	0.2056	6.25	21.12	99.48
4	Ammonium Sulfate	0.2061	6.30	21.24	100.04
5	Ammonium Sulfate	0.2061	6.30	21.24	100.04
6	Ammonium Sulfate	0.2063	6.30	21.22	99.94
Average				21.20%	99.87 %

Recovery Rate: 99.87 % ☒ Passed ☐ Failed

Relative Standard Deviation (RSD): 0.27 % ☒ Passed ☐ Failed

No.	Sample	Sample Weight (g)	Volume of titrant (ml)	Nitrogen (%)	Recovery Rate (%)
1	Blank	-	0.05		
2	Blank	-	0.05		
3	Glycine	0.2060	5.55	18.70	100.11
4	Glycine	0.2059	5.55	18.71	100.16
5	Glycine	0.2067	5.55	18.64	99.77
6	Glycine	0.2064	5.55	18.66	99.92
Average				18.68%	99.99%

Recovery Rate: 99.99 % ☐ Passed ☐ Failed

Relative Standard Deviation (RSD): 0.18 % ☐ Passed ☐ Failed

Note:

- The recovery rate should be between 98 – 102 %
- The relative standard deviation should be lower than 1%


Buchi (Thailand) Limited

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Performance Test

4. Summary

All specifications OK	Specification not OK
OK	



Comments

% Recovery : Pass



Buchi (Thailand) Limited

Signature BUCHI

- Service by Jiraporn Date 16 June 2022

- Approve by Siraphan C. Date 20 June 2022