

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาวิทย์ แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatani Rd., Bangkokphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Wavelength accuracy			
Cu at 324.8 nm	323.0 nm – 326.0 nm	324.7 nm	Pass
As at 193.7 nm	192.0 nm – 195.0 nm	193.7 nm	Pass
K at 766.5 nm*	765.0 nm – 768.0 nm	766.6 nm	Pass
Other.....			
High solids nebulizer setting**			
Uptake rate	7.2 – 10.6 ml / min	9.0 ml/min	Pass
Max Abs	≥ 0.75 Abs	0.79 Abs	Pass
Precision(%RSD)	≤ 0.5 %	0.3 %	Pass
Zeeman Background Correction Accuracy (%)**			
BCA @ Au 242.8 nm	< 3.7 %	***	***
Zeeman Magnetic Sensitivity Ratio (%)**			
MSR @ Cu 324.7 nm	> 70 %	***	***
Characteristic mass and sensitivity ****			
Sensitivity	≥ 0.21 Abs	****	****
Precision (%RSD)	≤ 4.0 %	****	****

* for Wideband PMT (Wavelength 190nm – 900nm)

** for Flame system

*** for Zeeman system

**** for Graphite furnace system



APPROVED BY :

Signature: 

Service Manager : Suchai Sanguanklathchai

Date : 23 / Dec / 2020

CALIBRATED BY :

Signature: 

Engineer : Suriya Nacharoen

Date : 23 / Dec / 2020

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SERVICE DEPARTMENT

PR-SV-025 Rev.11



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ATOMIC ABSORPTION SPECTROMETER TEST CERTIFICATE

Certificate No : SV2012/19048
Instrument Type : ATOMIC ABSORPTION SPECTROMETER
Model : AA 240
Serial Number : AA0909M072
Organization : S.P.J. Scientific Co., Ltd.
Address : 80 Soi Nakkeera Lamthong 3, Thap Chang, Sapansoong, Bangkok 10250
Date : 23 Dec 2020

Hollow cathode lamps used

Element	Lamp number	Comments
Arsenic	56-101003-00	
Copper	56-101014-00	
Potassium	56-101042-00	
Gold	56-101021-00	

Test description	Specification	Result	Comments
Light throughput (%Gain) or (EHT)			
Cu at 324.8 nm	≤ 64 % or 380 V	41 %	Pass
As at 193.7 nm	≤ 80 % or 540 V	67 %	Pass
K at 766.5 nm*	≤ 84 % or 540 V	56 %	Pass
Other.....			
Photometric noise Cu BGC off			
STDV @ 0	≤ 0.0005	0.0000	Pass

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SERVICE DEPARTMENT

PR-SV-025 Rev.11

Preparation Information:

This standard is prepared using 99.9999% pure copper metal which was purchased from a qualified vendor per ISO 9001:2008 guidelines and assayed by analytical methods for conformity prior to use. This standard was manufactured under appropriate laboratory conditions using the methods developed at NIST for SRM Spectrometric Standard Solutions. Sub-boiling distilled high-purity acid has been used to place the materials in solution and to stabilize the standard. The matrix is as noted above in 18 megaohm deionized water. Stability of this product is based upon rigorous short term and long term testing of the solution for the certified value. This testing includes, but is not limited to, the effect of temperature and packaging on the product. If during the period of validity, a recall is instituted due to substantial changes in the stability of this product, the purchaser will be notified.

Homogeneity:

This product is determined to be homogeneous following in-house procedures developed in accordance with the requirements of ISO Guide 34 and ISO Guide 35.

Intended Use:

This product is intended for use as a calibration standard, quality control standard, and/or for the validation of analytical methods. The standard is confirmed homogeneous; therefore, the minimum sample size should be consistent with the end user's measurement capabilities.

Traceability Information:

The traceability of this standard is maintained through an unbroken chain of comparisons to appropriate standards with suitable procedure and measurement uncertainties. The maintenance of the base and derived units of International System of Units (SI) with traceability of measurement results (contemporary metrology) to SI ensures their comparability over time as follows.

a. Standard Weight and Analytical Balance

The standard weights (NBS weights Inventory No. 20231A) are calibrated every two years by South Carolina Metrology Laboratory that is a participant in "NIST Weights and Measures Measurement Assurance Program" with a certificate of measurement traceability to NIST primary standards. The balances are calibrated yearly by the ISO 17025 accredited metrology service, and are verified weekly by an in-house method using standard weights.

b. Volumetric Device

The calibration of volumetric vessels are verified using the ASTM method E542.

c. Thermometer

The standard thermometers are calibrated every year by the ISO 17025 accredited metrology service. The thermometers used in-house are verified against the standard thermometers yearly.

d. Calibration Standards:

The Calibration Standard is traceable to SRM 3100 Series Spectrometric Standard Solutions. If an SRM is not available, a second source standard or independent lot is used.

Refer to Safety Datasheet (SDS) for hazardous information.

NOTICE: HPS products are intended for laboratory use only. All products should be handled and used by trained professional personnel. The responsibility for the safe handling and use of these products rests solely with the buyer and/or user. The data and information is stated by the manufacturer of the product. The information provided in this certificate pertains only to the lot number specified. None of the information provided in this certificate may be used, reproduced or transmitted in any form or by any means without written approval from High-Purity Standards.

Certificate of Analysis

Certified Reference Material



ISO Guide 34:2009 (RM) Accreditation
Certificate Number AP-1426
ANAB
ACCREDITED
ISO/IEC 17025:2005 Accredited on
Certificate Number AT-1520

Product Description:

Product Number: 100014-1
Lot Number: 1833105
Matrix: 2% (v/v) HNO₃

Certified Value:

Element	(μg/mL)	SRM ID	SRM Lot#
Copper	1000 ± 3	3114	121207

The Certified value is based on gravimetric and volumetric preparations, and verified against NIST SRM 3100 series when available via inductively coupled plasma optical emission spectrometry (ICP-OES) and/or inductively coupled plasma mass spectrometry (ICP-MS) using an internal laboratory-developed method. The uncertainty in the certified value is calculated for a 95% confidence interval and coverage factor *k* is about 2.

* Refer to Traceability Information, Section d
Density: 1.014 g/mL ± 0.002 g/mL @ 20.0°C ± 0.3 °C

Uncertified Values:

Trace Metal Impurity Scan: The data reported are based upon a scan of this specific lot via ICP-OES/ICP-MS analysis. The values are reported in μg/L.

Ag < 0.02	Cu	M	Li < 0.02	Rb < 0.02	Th < 0.02
Al < 0.05	Dy < 0.02	Lu < 0.02	Mg < 0.1	Re < 0.02	Ti < 0.02
As < 0.05	Er < 0.02	Mn < 0.05	Mo < 0.02	Rh < 0.02	Tl < 0.02
Au < 0.02	Eu < 0.02	Na < 5	Se < 0.02	Ru < 0.02	Tm < 0.02
B < 1	Fe < 1	Nb < 0.02	Si < 0.1	Sb < 0.02	U < 0.05
Ba < 0.02	Ga < 0.02	Nd < 0.02	Sn < 0.02	Sc < 0.02	V < 0.05
Be < 0.02	Gd < 0.02	Ni < 0.02	Sr < 0.02	Se < 0.1	W < 0.02
Bi < 0.02	Ge < 0.02	Os < 0.02	Ta < 0.02	Si < 5	Y < 0.02
Ca < 1	Hf < 0.02	Pb < 0.5	Tb < 0.02	Sm < 0.1	Yb < 0.02
Cd < 0.02	Ho < 0.02	Pd < 0.02	Te < 0.02	Sn < 0.02	Zn < 5
Ce < 0.02	In < 0.02	Pt < 0.02		Sr < 0.02	Zr < 0.02
Co < 0.05	Ir < 0.02			Ta < 0.02	
Cr < 0.05	K < 1			Tb < 0.02	
Cs < 0.02	La < 0.02			Pt < 0.02	

Packaging and Storage Conditions:

The standard is packaged in a pre-cleaned polyethylene bottle. To maintain the integrity of this product, the solution should be kept tightly capped and stored under normal laboratory conditions.

Expiration Information:

The expiry date is guaranteed to be valid for eighteen months from the shipping date provided and is guaranteed through the month of expiration. For this reason, standards from the same lot may have different expiration dates.

Shipped Date: January 2019

Certificate Issue Date: December 10, 2018

Moven Mudunuri

Moven Mudunuri, Ph. D. Laboratory Manager



This is to certify that

Suriya Nacharoen

has completed **Customer Support and Basic Application Training** on

AA Instrument & Accessories

and is authorised to support this product

Burn Ngamvitt

Approve by

Somchai Noomfak

Somchai Noomfak
Service manager

Trainer: **Burn Ngamvitt**
August 2007
Refer to training course by varian
Thaunique
Australia
80-82 Prachatapatai Rd, Bangkokunprom
Pranakorn Bangkok, Thailand

we innovate we respect we care we learn we deliver

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Safety Data Sheet acc to OSHA HCS Safety Data Sheet acc to OSHA HCS

1 Identification

Product identifier: 100014-L-Copper (1000µg/ml in 2% HNO3)

Trade name: 100014-L-Copper (1000µg/ml in 2% HNO3)

Details of the supplier of the safety data sheet: High-Purity Standards, 11273, Charleston, SC 29423, USA, P.O. Box 41273, Telephone: (843) 767-7900, FAX: (843) 767-7906

Emergency telephone numbers: NORTHEAST: 1-800-535-5053, Other emergency telephone numbers: 1-800-535-5053

2 Hazard(s) identification

Classification of the substance or mixture: GHS05, H290, H314, H335

Signal word: Danger

Hazard pictograms: GHS05

Hazard statements: H290 May be corrosive to metals, H314 Causes severe skin burns and eye damage, H335 Causes serious eye damage

Precautionary statements: P273, P280, P303+P361+P531, P304+P340, P305+P351+P338, P312, P321, P330, P332+P313, P337+P313, P361+P353, P370+P378, P403+P233, P501

3 Composition/information on ingredients

Chemical identification of the substance/preparation: 100014-L-Copper (1000µg/ml in 2% HNO3)

4 First-aid measures

5 Stability and reactivity

6 Hazardous properties

7 Transport hazard classification

8 Environmental

9 Other hazards

10 Additional information

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8 Environmental

9 Other hazards

10 Additional information



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



Certificate No. : MC20-2376
Page : 2 of 2

Function : pH measurement (Electrode)
Calibration point : 4, 7, 10 pH
Probe S/N : 210392564475.00

Standard Buffer (pH)	UUC* reading (pH)	UUC* correction (pH)	Uncertainty of measurement (+/- pH)
4.00	4.00	0.00	0.017
7.00	7.01	-0.01	0.017
10.00	10.02	-0.02	0.017

Function : Temperature measurement
Calibration point : 20, 25, 30 °C
Result : Without adjustment
Resolution : 0.1 °C

Calibration point (°C)	Standard reading (°C)	UUC* reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
20	20.00	20.0	0.00	0.12
25	25.00	25.0	0.00	0.12
30	30.00	30.0	0.00	0.12

UUC* = Unit under calibration

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Certificate of Calibration

Certificate No. : MC20-2376
Page : 1 of 2

Customer : S.P.J. Scientific Co., Ltd.
Address : 80 Soi Saphansong, Saphansong, Bangkok 10250

Description : pH Meter
Manufacturer : Hach
Model : HQ11D
Serial No. : 200800040522
Identification No. : N/A
Calibration Place : Customer Laboratory
Order No. : 2758/20
Received date : Sep 14, 2020
Calibration date : Sep 14, 2020
Environment Condition :
Temperature : (25±10) °C
Humidity : (50±30) %RH

Calibration Method : Calibration were conducted using in-house calibration procedure CP-MC-001 According to direct with Standard Thermometer and Standard Buffer Solution at 25 °C. The calibration methods based on ISO 10523 Water quality - Determination of pH, NIST : 1994.
Calibration were conducted using in-house calibration procedure CP-MT-001 According to comparison with Standard Digital Thermometer.
The calibration methods based on ITS-90.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
Digital Thermometer	EFT-4	EFT42020033	MT20-4107	May 12, 2021
Standard Digital Thermometer	UM RTD	2002Z 238 0073A	MT19-7353	Dec 17, 2020
Instrument	Model	Lot No.	Expired Date	
Standard Buffer Solution (4 pH)	104025	418F1	Jun 28, 2021	
Standard Buffer Solution (7 pH)	107025	M719B1	Feb 28, 2021	
Standard Buffer Solution (10 pH)	1100525C	1125C20C2	Mar 28, 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 of k = 2, providing a level of confidence of not less than 95%

Calibrated by : Miss Nuengruethai Siripoch
Issue date : Sep 15, 2020

Approved by :
(Mr.Panuwat Phuklan)

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Certificate of Calibration

Certificate No. : 63-200218-1

Page : 2 of 2

Result of Calibration : After Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)	Error before Adjustment (g)
0.1 /	0.0000	0.00011	0.0000
1 /	-0.0001	0.00011	0.0000
5 /	-0.0001	0.00012	0.0000
10 /	0.0000	0.00012	-0.0001
20 /	-0.0001	0.00013	-0.0002
50 /	-0.0001	0.00014	-0.0004
70 /	-0.0001	0.00020	-0.0005
100 /	0.0000	0.00020	-0.0006
150 /	0.0000	0.00038	-0.0014
200 /	-0.0001	0.00038	-0.0021

$$* Err = Coverage \times (-1)$$

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.11$, providing a level of confidence of approximately 95%

Eccentric error	Load test : 50 g	A	B	C	D	E
		-0.0001	-0.0001	-0.0002	0.0000	0.0000

$$MPE \pm 0.0005$$

Repeatability Load test : 200 g

Sidev. : 0.00005 g

$$Err < MPE$$

$$(150 \text{ } 10012 : 23023)$$

-o0o-

Certificate of Calibration

Certificate No. : 63-200218-1

Page : 1 of 2

Submitted by :

S.P.J. Scientific Co., Ltd.

80 Soi Nakkilalaenthong 3, Thapchang, Saphansung, Bangkok 10250

Equipment :

Electronic Balance

Manufacturer : METTLER TOLEDO Model : AL204

Serial No. : 1228320221 ID No. : SPJ-TE-012

Capacity : 210 g Resolution : 0.0001 g

Environment :

On site calibration was carried out at the Balance Room, S.P.J. Scientific Co., Ltd.

Ambient Temperature : (26.2 to 26.5) °C

Relative Humidity : (51.4 to 55.8) %

Air Pressure : 1007.0 mbar

Date of Received : 06 July 2020

Date of Calibration : 06 July 2020 /

Date of Issue : 07 July 2020

Calibrated by :

Akaradath Thippichai

Calibration Method :

In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 5, July 2015

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

Standard Weights	Cert. No.	Due Date	Traceability
ID No. E261-E2624	C02192873	14 Nov 2020	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Pronthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 63-200218-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1 ✓	0.00000	0.000016
0.5 ✓	-0.00001	0.000022
1 ✓	0.00000	0.000026 ✓
5 ✓	-0.00001	0.000043
10 ✓	0.00000	0.000053
20 ✓	0.00000	0.000071
50 ✓	0.0001	0.00014 ✓
70 ✓	0.0001	0.00020
100 ✓	0.0002	0.00020
120 ✓	0.0003	0.00038

$$\% \text{Err} = \frac{\text{Correction}}{\text{Nominal Value}} \times (-1)$$

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.07$.

providing a level of confidence of approximately 95%

Eccentric error	Load test :	20 g
	A	B C D E
		-0.00005, 0.00008, 0.00007, -0.00004, 0.00000, g

$$\text{MPE} \pm 0.0005$$

Repeatability	Load test :	100 g
	Stdev.	0.000052 g

-o0o-

P.P.

Certificate of Calibration

Certificate No. : 63-200218-2

Page : 1 of 2

Submitted by : S.P.J. Scientific Co., Ltd.

80 Soi Nakkhilaemthong 3, Thapchang, Saphansung, Bangkok 10250

Equipment : Electronic Balance

Manufacturer : METTLER TOLEDO Model : MS105DU

Serial No. : B216861078 ID No. : SPJ-TE-013

Capacity : 120 g Resolution : 42g/0.00001g, 120g/0.0001g

Environment : On site calibration was carried out at the Balance Room, S.P.J. Scientific Co., Ltd.

Ambient Temperature : (26.5 to 26.7) °C

Relative Humidity : (47.2 to 51.1) %

Air Pressure : 1007.0 mbar

Date of Received : 06 July 2020

Date of Calibration : 06 July 2020 ✓

Date of Issue : 07 July 2020

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 5, July 2015

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

Standard Weights	Cert. No.	Due Date	Traceability
ID No.	C02192873	14 Nov 2020	National Institute of Metrology (Thailand), (NIMT)
E261-E2624			

Approved by :

(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CERTIFICATE OF CALIBRATION

Issue Date : 6 August 2020 Certificate No. : 20-698-004
Work Order No. : 20/698

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY57006241	20-191-008	01 April 2021
Sensor type	RTD	RTDH 301-309	20-191-008	01 April 2021

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

: On - Site

: Without adjustment

: Time Constant : - Hour 33 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 = 0.6 m ; H = 1.2 m

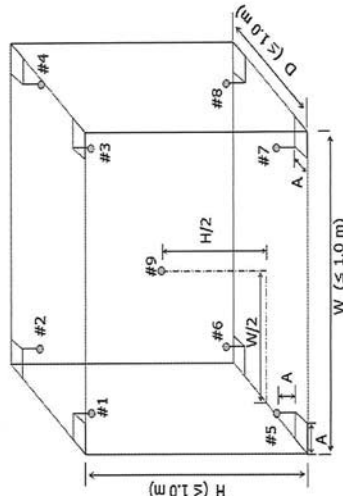


Diagram of Chamber

CERTIFICATE OF CALIBRATION

Issue Date : 6 August 2020 Certificate No. : 20-698-004
Work Order No. : 20/698

Customer Name : S.P.Jscientific Co.,Ltd.
80 Soi Saphansoong,Saphansoong,
Bangkok 10250

Date of Received : 23 July 2020

Date of Calibration : 23 July 2020

Instrument Details

: Description : Temperature Controlled Enclosures [Incubator]

Manufacturer : SPJ Scientific

Model : N/A

Serial No. : N/A

ID No. : SPJ-TE-028

Resolution : 0.1 °C

Location : Service Room

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	Minimum	36 °C	Maximum	36 °C
Humidity	Minimum	58 %	Maximum	63 %
Line Voltage	Minimum	224 VAC	Maximum	226 VAC

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. Wuttinun Yindeepot
Calibration Engineer

Approved by :
(Mr. Anuwat Yakermjit)
Laboratory Manager

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Crystal Calibration Sales and Service Co., Ltd.

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

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





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Salmali, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Calibration Cert. # 3894.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : MT20-6250

Page : 1 of 2

Customer Address
: S.P.J.Scientific Co.,Ltd.
: 80 Soi Saphansoong, Saphansoong, Bangkok 10250

Description
Manufacturer
Model
Serial No.
Identification No.
Calibration Place
: Oven
: Memmert
: UF55
: B213.1226
: IDSPJ-TE-003
: Customer Laboratory

Calibration Method
: Calibration were conducted using In-house calibration procedure CP-MT-006 According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on DKD-R5-7 guidelines for calibration of climatic chamber edition 07-2009.

Reference Standard Instruments :
Instrument
LXI Data Acquisition Switch Unit with Sensor
Serial No.
MY49001901
Certificate No.
MT119-7350
Due Date
Dec 10, 2020

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 : Mr.Jiraphan Sreebanmasarn
Issue date : Sep 15, 2020
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



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.
45/48 Soi Salathammassop31, Salathammassop Rd.,
Salathammassop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



NSC-TIS-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 20-698-004
Work Order No. : 20/698

Issue Date : 6 August 2020

Result of Temperature Distribution and Performance Check

Table 1 : 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	20.31	20.29	20.34	20.47	20.32	20.28	20.20	20.30	20.40	0.36

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	20.0	20.0	0.25	0.59	0.61

Note

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 $k=2$ providing a level of confidence of approximately 95%.



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



Certificate of Calibration

Certificate No. : MT20-6313
Page : 1 of 2

Customer : S.P.J.Scientific Co.,Ltd.
Address : 80 Soi Saphansoong, Saphansoong, Bangkok 10250

Description : Oven
Manufacturer : Memmert
Model : UF55
Serial No. : B213.1228
Identification No. : IDSP-J-TE-003
Calibration Place : Customer Laboratory

Order No. : 2759/20
Received date : Sep 14, 2020
Calibration date : Sep 14, 2020

Environment Condition :
Temperature : (25 \pm 10) °C
Humidity : (50 \pm 30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure CP-MT-006 According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on DKD-R5-7 guidelines for calibration of climatic chamber edition 07-2009.

Reference Standard Instruments :
Instrument : LXI Data Acquisition Switch Unit with Sensor
Model : 34972A
Serial No. : MY49007901
Certificate No. : MT19-7350
Due Date : Dec 10, 2020

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 : Mr.Jiraphan Sreebannasarn
Issue date : Sep 18, 2020
Approved by : (Mr.Panuwat Phukian)

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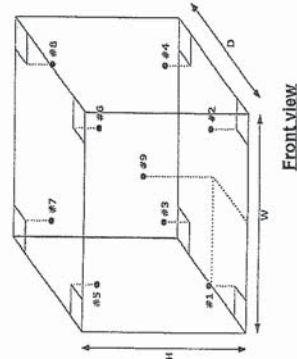
Certificate No. : MT20-6250
Page : 2 of 2

Function : Temperature measurement
Calibration point : 104 °C

Result : Without adjustment
Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
104	104.175	104.340	104.387	104.347	104.338	104.275	104.397	104.300	104.398	0.44

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
104.0	104.0	0.23	0.50	0.54



UUC* = Unit under calibration
Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.
Overall Variation = Difference of temperature value between the maximum and minimum any time.
Stability = One half of the maximum difference of measured temperatures at any one probe.



Certificate of Calibration

Certificate No. : 63-400341-1 Page : 1 of 2

Submitted by : S.P.J.Scientific Co.,Ltd.

Equipment : Air Chamber (Refrigerator)

Manufacturer : BT Metrology Model : REF-950

Range : N/A °C Resolution : 0.1 °C

Serial No. : 5-12-11 ID No. : SPJ-TE-014

Environment : On site calibration was carried out at the Laboratory, S.P.J.Scientific Co.,Ltd.

Ambient Temperature : 29.0 to 30.5) °C

Relative Humidity : (50 to 55) %

Line Voltage : (229.0 to 229.8) V

Date of Received : 06 July 2020

Date of Calibration : 06 July 2020

Date of Issue : 10 July 2020

Calibrated by : Permon Champu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No. Cert. No. Due Date Traceability

400029 & 400030 63-400111-1 27 Sep 2020 National Institute of Metrology Thailand (NIMT)

Approved by : 
(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate No. : MT20-8313

Page : 2 of 2

Function : Temperature measurement

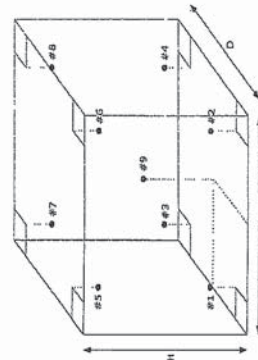
Result : Without adjustment

Calibration point : 180 °C

Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
180	181.162	180.593	180.264	180.853	180.613	180.519	181.376	180.241	181.224	0.44

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
180.0	180.0	0.20	1.2	1.4



- #1 Lower Left Front
- #2 Lower Right Front
- #3 Lower Left Rear
- #4 Lower Right Rear
- #5 Upper Left Front
- #6 Upper Right Front
- #7 Upper Left Rear
- #8 Upper Right Rear
- #9 Geometric Center

Front view

UUC* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature value between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe.



Certificate of Calibration

Page : 1 of 2

Certificate No. : 63-400341-5

Submitted by : S.P.J. Scientific Co., Ltd.

80 Soi Nakkhilaenthong 3, Thapchang, Saphansung, Bangkok 10250

Equipment :

Water Bath

Manufacturer : Memmert

Model : WNE22

Range : N/A °C Resolution : 0.1 °C

Serial No. : L516.0898 ID No. : N/A SPJ-TE-030

Environment :

On site calibration was carried out at the Laboratory, S.P.J. Scientific Co., Ltd.

Ambient Temperature : (27.6 to 28.8) °C

Relative Humidity : (54 to 58) %

Line Voltage : (219.4 to 223.0) V

Date of Received :

06 July 2020

Date of Calibration :

06 July 2020

Date of Issue :

10 July 2020

Calibrated by :

Bunjerd Masri

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD probe

ID No.

Cert.No.

Due Date

Traceability

400022 & 400024

63-400106-1

29 Aug 2020 National Institute of Metrology Thailand (NIMT)

Approved by : 
(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Page : 2 of 2

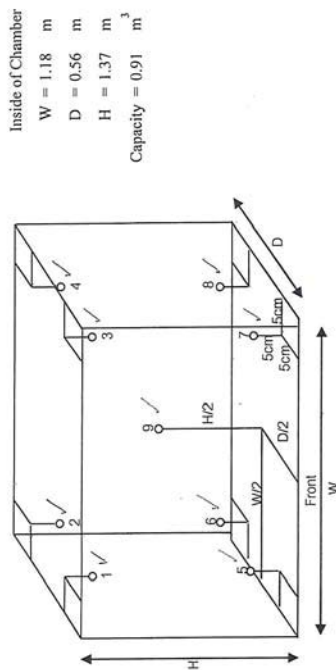
Certificate No. : 63-400341-1

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber
 W = 1.18 m
 D = 0.56 m
 H = 1.37 m
 Capacity = 0.91 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4.0	4.0	4.0	3.6	3.6	4.1	3.8	3.8	3.8	4.1	3.7	3.6	0.56
			-0.4	-0.4	-0.1	-0.2	-0.2	-0.2	-0.1	-0.2	-0.4	
Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)			Measured Stability (°C)			Overall Variation (°C)			
			0.7	0.7	0.7	0.1	0.1	0.1	0.9	0.9	0.9	
4.0	4.0	4.0	0.7	0.7	0.7	0.1	0.1	0.1	0.9	0.9	0.9	

Remark The uncertainty is not combine uniformity of the air chamber

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

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

-o0o-

$$MPE \pm 2^\circ C$$

$$Err < MPE$$

$$(7.50/100(2.2065) \times 4/10) \times 1.5$$

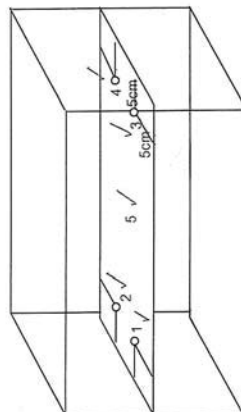


Certificate No. : 63-400341-5

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.	Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
85.0	85.0	85.0	1 / 84.95 2 / 84.95 3 / 84.94 4 / 84.92 5 / 84.94	0.18	0.05	0.03

$E_{yr} = -0.05\% - 0.05\% - 0.05\% - 0.05\% - 0.05\%$

Remark: The uncertainty is not combine uniformity of the water bath

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

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

-o0o-

$MPE \pm 1^\circ C$

$E_{yr} < MPE$

13/08/2020 13/08/2020 4/8/20

B



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

Cert.No.: 20CHO506
Page.: 1 of 3

Certificate of Calibration

Equipment : Spectrophotometer

Manufacturer : LabTech

Model : BlueStar A

Serial No. : 301234

ID No. : SPJ-TE-040

Condition As-Received: New Item

Received Date : 11 August 2020

Calibration Date : 11 August 2020

Reference : 2008-0169ON-1

Submitted by : S.P.J. SCIENTIFIC COMPANY LIMITED
80 Soi Nakklalaemthong 3, Thap Chang,
Saphansong, Bangkok 10250, Thailand.

Calibration Place : LAB 2

Ambient Temperature : (25.9 - 24.2) °C (On-Site)

Relative Humidity : (60.3 - 57.7) % (On-Site)

Calibration Procedure : In - house method : CP-OCH4
based on direct measurement by
using wavelength standard filter and
absorbance standard filter

Calibrated by : Sathip Meangmai

Approved by : Malu
Approved Signatory

() Pornthippa Tameyakul
() Malee Bulkrua
() Sathip Meangmai

Issue Date : 13 August 2020

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. : 20CHO506

Page : 3 of 3

Calibration Results : without adjustment
Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor k
420.0	Zero	0.0000	0.0028	2.00
	0.5714	0.5715	0.0028	2.00
	1.0239	1.0246	0.0028	2.00
	2.1933	2.1922	0.0060	2.00
546.1	Zero	0.0000	0.0028	2.00
	0.5202	0.5209	0.0028	2.00
	1.0021	1.0038	0.0028	2.00
	1.9995	1.9990	0.0061	2.00
635.0	Zero	0.0000	0.0028	2.00
	0.5617	0.5624	0.0028	2.00
	1.0965	1.0979	0.0028	2.00
	1.9290	1.9265	0.0060	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 %.

-o0o-

Wala.



Cert. No. : 20CHO506

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	30152	79279	23 Sep 2021
2. Wavelength Standard set	14536	74104	10 Jan 2021
3. Wavelength Standard set	14537	74105	10 Jan 2021

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 : 2 nm

Scan Speed : Low

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor k
418.61	418.5	0.18	2.00
460.05	459.7	0.18	2.00
528.83	528.6	0.20	2.05
585.29	585.3	0.18	2.00
637.98	638.0	0.17	2.00

Wala.