

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

ANALYTICAL BALANCE (DU)

Model. : XS205DU

Serial No. : 1126323724



Certificate No. : 23-006683
Sample Code : 23-02820-006

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by Mr. Thanadol Pholthep
Scientist

Issue date 25 January 2023

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

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)



Certificate No. : 23-006683
Sample Code : 23-02820-006

REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE
Manufacturer : METTLER TOLEDO
Model : XS205DU
Capacity : Max 81 g / 220 g
Resolution : 0.01 mg / 0.1 mg
Serial No. : 1126323724
ID No. : LABE 05/1

Result of Calibration

1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g	Range : 80	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	40	30
<input type="checkbox"/> Adjustment	Standard weight	40.000042	80.000045
	Average reading of indicator	40.000015	90.000019
	Standard deviation	0.000004	0.000007
Unit : g	Range : 200	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199
	Average reading of indicator	100.00001	200.00004
	Standard deviation	0.000004	0.000008

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Certificate No. : 23-006683

Sample Code : 23-02820-006

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

Range :	Test Point	Sensitivity, S		Range :	Test Point	Sensitivity, S	
		Value	Uncertainty			Value	Uncertainty
80	0	0.99800	0.00003	200	0	0.9980	0.00003
	40	0.99800	0.00003		100	0.9980	0.00003
	80	0.99800	0.00003		200	0.9980	0.00003

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator		Correction Value	Expanded Uncertainty	Coverage Factor (k)
		Value	Uncertainty			
Unload	0.0000000	0.00000	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	-0.00003	0.000020	2.00
10	10.0000000	10.00007	-0.00007	-0.00007	0.000032	2.00
20	20.000016	20.00011	-0.00009	-0.00009	0.000036	2.00
50	50.000029	50.00013	-0.00010	-0.00010	0.000067	2.00
100	100.000022	100.00001	-0.00001	-0.00001	0.000016	2.00
150	150.000051	150.00001	0.00000	0.00000	0.000023	2.00
200	200.000199	200.00003	-0.00016	-0.00016	0.000028	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

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Certificate No. : 23-006683

Sample Code : 23-02820-006

REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan	Range	Test weight : 50 and 100		Reading of Indicator
		Unit : g	Unit : g	
<input type="radio"/> Circle <input type="radio"/> Triangular <input checked="" type="radio"/> Rectangular	80	50.00014	100.00014	100.00014
<input type="radio"/> Circle <input type="radio"/> Triangular <input checked="" type="radio"/> Rectangular	200	50.00014	100.00014	100.00014

Maximum difference
0.00008

Condition of Calibration

1. Calibration Method : Wt-CL-004 base on UKAS LAB 14: 2019

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

3. Condition of Calibration item: Normal

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

- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

5. Reference standard instrument :

1) STANDARD WEIGHT 1 mg to 1 kg

Class E2

ID No. LB-WE-57

Certificate No. 22-G06039

Due Date 27 June 2023

Rev.03

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-004TEL 02-516-2422
FAX 02-516-6949
Rev.03

- End of Report -

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ANALYTICAL BALANCE

Model : MS204TS/00

Serial No. : B904136539

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServicesSupport@mt.com

METTLER TOLEDO



NSC-TIS-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham
City: Sriracha
Zip / Postal: 20230
State / Province: Chonburi
Contact: Sasiporn Nakin
Order Number: 0332630077

Weighing Device

Manufacturer: Mettler Toledo
Model: MS204TS000
Serial No.: B904136539
Building: Laboratory
Floor: 1
Room: Balance
Instrument Type: LABE 05/4
Asset Number: N/A
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
CP/W002/20
METTLER TOLEDO Work Instruction:
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 25.6 °C	End: 25.2 °C	Start: 50.5 %	End: 44.6 %

As Found Calibration Date: 06-Feb-2023
As Left Calibration Date: N/A
Issue Date: 07-Feb-2023
Calibrator: Thiraphong Salanoi
Approved Signatory: [Signature]

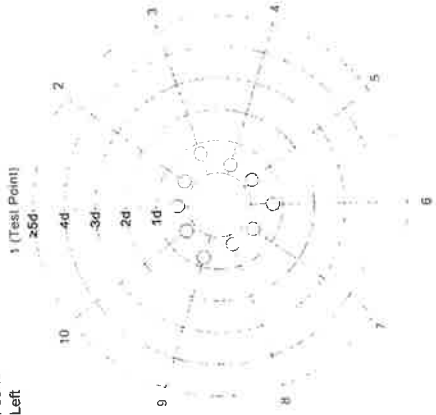
Technical Manager / Head of Calibration Center

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Measurement Results

Repeatability

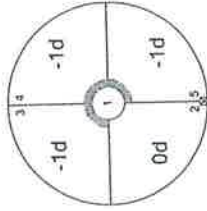
Test Load: 100 g		
	As Found	As Left
1	100.0002 g	N/A
2	100.0002 g	N/A
3	100.0001 g	N/A
4	100.0002 g	N/A
5	100.0002 g	N/A
6	100.0001 g	N/A
7	100.0002 g	N/A
8	100.0002 g	N/A
9	100.0001 g	N/A
10	100.0002 g	N/A
Standard Deviation	0.00005 g	N/A



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	100.0002 g	N/A
2	100.0002 g	N/A
3	100.0001 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A
Maximum Deviation	0.0001 g	N/A

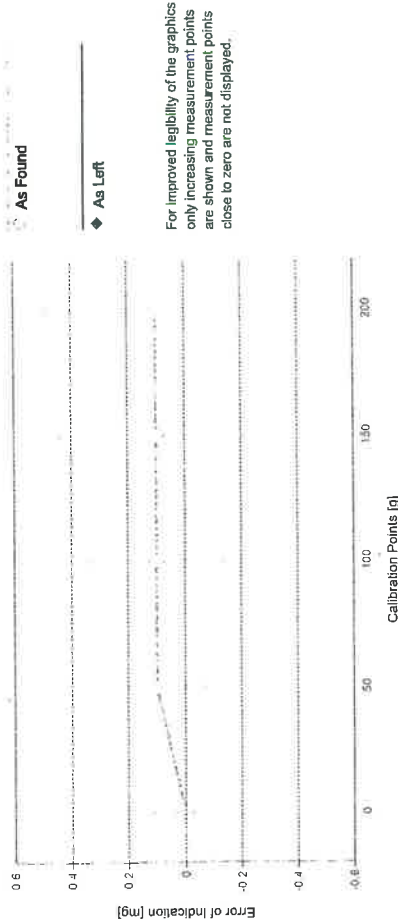


As Found

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	0.11 mg	2
2	0.0100 g	0.0100 g	0.0000 g	0.13 mg	2
3	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
4	0.1000 g	0.0999 g	-0.0001 g	0.13 mg	2
5	1.0000 g	0.9999 g	-0.0001 g	0.13 mg	2
6	5.0000 g	4.9999 g	-0.0001 g	0.13 mg	2
7	10.0000 g	9.9999 g	-0.0001 g	0.14 mg	2
8	50.0000 g	50.0001 g	0.0001 g	0.17 mg	2
9	100.0001 g	100.0002 g	0.0001 g	0.24 mg	2
10	150.0001 g	150.0002 g	0.0001 g	0.34 mg	2
11	200.0001 g	200.0002 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.:	WS28	Date of Issue:	01-Apr-2022
Certificate Number:	178498	Calibration Due Date:	17-Sep-2023
Thermo Hygrometer			
Equipment No.:	IN306	Date of Issue:	10-Jan-2023
Certificate Number:	2314	Calibration Due Date:	03-Jan-2024



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: $5 K$

Linearization of Uncertainty Equation

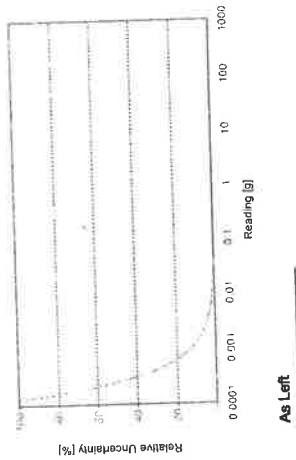
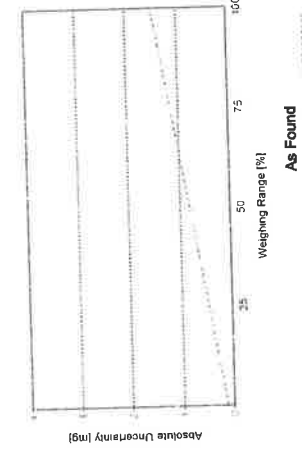
Range		As Found	As Left
d	Max		
1	0.0001 g	220 g	N/A

$U_1 = 0.13 \text{ mg} + 0.00625 \text{ mg/g} \cdot R$

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
0.2200 g	0.13 mg	0.060%	N/A
2.2000 g	0.14 mg	0.0065%	N/A
22.0000 g	0.27 mg	0.0012%	N/A
220.0000 g	1.5 mg	0.00068%	N/A



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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.

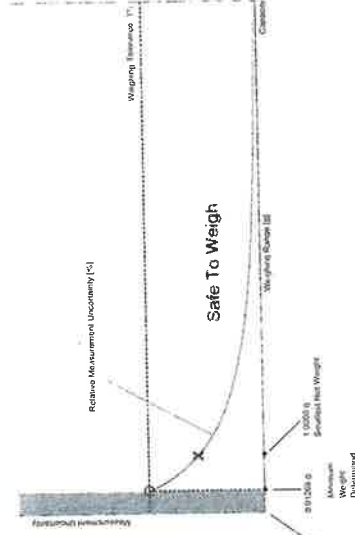
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 1.0000 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.

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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%	0.12729 g	0.25618 g	0.38672 g	0.65284 g	1.34917 g
0.2%	0.06344 g	0.12729 g	0.19153 g	0.32124 g	0.65284 g
0.5%	0.02533 g	0.05072 g	0.07618 g	0.12729 g	0.25618 g
1%	0.01266 g	0.02533 g	0.03802 g	0.06344 g	0.12729 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03167 g	0.06344 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02533 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%	0.12729 g	0.25618 g	0.38672 g	0.65284 g	1.34917 g
0.2%	0.06344 g	0.12729 g	0.19153 g	0.32124 g	0.65284 g
0.5%	0.02533 g	0.05072 g	0.07618 g	0.12729 g	0.25618 g
1%	0.01266 g	0.02533 g	0.03802 g	0.06344 g	0.12729 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03167 g	0.06344 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02533 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.

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Measurement Results

Results Summary

Repeatability			Eccentricity		Error of Indication	
As Found	As Left		As Found	As Left	As Found	As Left
✓	✓		✓	✓	✓	✓

✓ = Passed
✗ = Failed
N = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance		Control Limit		As Found		As Left	
				Std. Deviation	Result	Std. Deviation	Result
0.1%	0.1%	0.00050 g			✓		✓
0.2%	0.2%	0.00100 g			✓		✓
0.5%	0.5%	0.00250 g			✓		✓
1%	1%	0.00500 g		0.00005 g	✓	0.00005 g	✓
2%	2%	0.01000 g			✓		✓
5%	5%	0.02500 g			✓		✓

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%	0.1%	0.0500 g			✓		✓
0.2%	0.2%	0.1000 g			✓		✓
0.5%	0.5%	0.2500 g			✓		✓
1%	1%	0.5000 g		0.00001 g	✓	0.00001 g	✓
2%	2%	1.0000 g			✓		✓
5%	5%	2.5000 g			✓		✓

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

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Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.0000 g	0.0000 g	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	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.0000 g	0.0000 g	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	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 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.

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BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



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



CALIBRATION CERTIFICATE

Certificate No. : AD2205-163-0001
Date Issued : 20-May-22

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukchapibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Analog Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No./Tag No. : BM001/41

Date Received : 12-May-22

Date Calibrated : 20-May-22

Calibrated by : Mr. Saruth Srichutikul

Calibration Method or Calibration Procedure Used

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

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

Result of Calibration

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

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Approved by: K. Nathong

(Mr. Nathapong Krudaum)



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Certificate No : AD2205-163-0001

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading hPa	UUC Reading (hPa) Before Adjusted	UUC Reading (hPa) After Adjusted	UUC Error hPa	Uncertainty ± hPa
990.00	990.0	*	0.00	0.59
1000.00	1000.0	*	0.00	0.59
1010.00	1010.0	*	0.00	0.59
1020.00	1020.0	*	0.00	0.59
1030.00	1030.0	*	0.00	0.59

STD = Standard

UUC = Unit Under Calibration

Calibrated condition : Pressure Medium Air : Density = 1.19 kg/m³ @ 20°C, 1 bar
Mounting Position Vertical
Reference Level at center of its dial

Description of UUC :	Range	955 - 1075	hPa Absolute
	Calibration Range	990 - 1030	hPa Absolute
	Scale Interval	1	hPa
	Resolution	0.5	hPa Absolute

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P210086 for Reference Pressure Monitor Serial No. 1598, Due 08-Nov-22

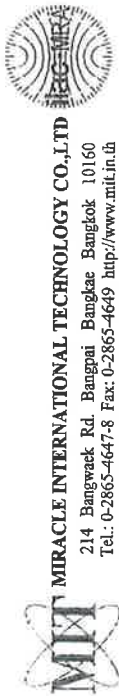
End of Certificate

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BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



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



CALIBRATION CERTIFICATE

Certificate No. : L202305085-002
Date Issued : 16-May-23

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukhapibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Analog Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No./Tag No. : BM001/41

Date Received : 11-May-23

Date Calibrated : 15-May-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

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

Result of Calibration

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

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

Approved by: *Sasayuth T.*
(Mr. Sarayuth Tochua)



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Certificate No : L202305085-002

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading	UUC Reading (mbar)	UUC Reading (mbar)	UUC Reading (mbar)	UUC Error	Uncertainty
mbar	Before Adjusted	After Adjusted		mbar	± mbar
990.00	990.0	*		0.00	0.61
1000.00	1000.0	*		0.00	0.61
1010.00	1010.0	*		0.00	0.61
1020.00	1020.0	*		0.00	0.61
1030.00	1030.0	*		0.00	0.61

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium Air : Density = 1.19 kg/m³ @ 20°C, 1 bar
Mounting Position Vertical
Reference Level at center of its dial
Conversion Factor Multiply by 1.0 E+02 - Pa unit

Description of UUC :

Range 990 - 1030 mbar Absolute
Calibration Range 990 - 1030 mbar Absolute
Scale Interval 1 mbar
Resolution 0.5 mbar Absolute

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P220104 for Reference Pressure Monitor Serial No. 1598, Due 11-Nov-23

End of Certificate

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030

Airgas
an Air Liquide company

Airgas
an Air Liquide company

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E03NI99E15AC0U4
Cylinder Number: EB0145030
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CH4,PPN,BALN
Reference Number: 160-402242242-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 350
Certification Date: Oct 15, 2021
Expiration Date: Oct 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 000R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
Assay Dates				
				10/15/2021
10/15/2021				
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%
NTRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
Expiration Date				
				May 15, 2025
				Mar 17, 2027
ANALYTICAL EQUIPMENT				
Instrument/Make/Model		Analytical Principle		Last Multipoint Calibration
Nicolet iS50 FTIR AUP2110295 CH4		FTIR		Oct 13, 2021
Nicolet iS50 FTIR AUP2110295 C3H8		FTIR		Oct 14, 2021

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.0 Kg
Net Weight: 4.9 Kg
PO# 5221004861



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Michael A. Hubbs
Approved for Release

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15ACX9C Reference Number: 82-401135335-1
Cylinder Number: EB0062815 Cylinder Volume: 144.4 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52018 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Mar 13, 2018
Expiration Date: Mar 13, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/531, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	16060507	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%
GMS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NTRM	12060735	CC556182	2488 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%
The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.				
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
Nicolet 6700 APW1100391 CO	FTIR	Feb 08, 2018		
Nicolet 6700 APW1100391 NO	FTIR	Feb 15, 2018		
Nicolet 6700 APW1100391 NO2	FTIR	Feb 16, 2018		
Nicolet 6700 APW1100391 SO2	FTIR	Mar 01, 2018		

Triad Data Available Upon Request

NOTES: NET WEIGHT: 10.43lbs
GROSS WEIGHT: 60.93lbs

PO# 5218000763

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol. Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All gases are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05

Donna M. Allen
Approved for Release

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DRY GAS METER XC-572V

Serial No. : 1110070

Certificate Of Calibration
Method 5 Pre-Test Console Calibration - Cubic Meters (m³)

Meter Console Information

Console Model #: XC-572V
Console Serial #: 1110070
DGM Model #: SK25EX
DGM Serial #: 0005413

Calibration Conditions

Calibration Reference No.: WDS-SV630994
Ambient Temp (°C): 28.4
Barometric Pressure (mm Hg): 766
Relative Humidity (%): 66

Factors/Conversions

Std Temp (°K): 298
Std Press. (mm Hg): 760
K₁: 0.392

Reference Equipment

WTM Model: W-NK04-6B WTM Serial: 546321
WTM Cal. Due: Mar-23 Gamma: 1.0000
WTM Thermometer: Internal

Metering Console				Calibration Meter				Outlet Temp	
Run Time (minutes)	Orifice, ΔH (mm H ₂ O)	Volume (m³)	Outlet Temperature (°C)	Volume (m³)	Initial	Final	Initial	Final	
(Q)	(P _o)	(V _o)	(T _o)	(V _o)	(T _o)	(T _o)	(V _o)	(V _o)	(T _o)
min	mm H ₂ O	m³	°C	m³	°C	°C	m³	m³	°C
15.00	13.0	397.7244	397.9056	25	25	289.58787	289.76942	25	25
10.00	25.0	397.9285	398.0984	25	26	289.79207	289.95964	25	25
8.00	50.0	398.1162	398.3058	26	26	289.97735	290.16549	25	25
7.00	80.0	398.3366	398.5469	26	26	290.19612	290.40517	25	25
5.00	120.0	398.5693	398.7513	26	27	290.42752	290.60906	25	25

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Calibration Factor		Flowrate	ΔH @ (mm H ₂ O)
(V _{test})	(Q _{test})	(V _{ref})	(Q _{ref})	Value	Variation	Std & Corr	(ΔH _o)
m³	m³/min	m³	m³/min	(Y)	(ΔY)	(Q _o)	(ΔH _o)
0.180	0.012	0.181	0.012	1.001	0.009	0.012	41.038
0.169	0.017	0.167	0.017	0.986	-0.006	0.017	41.198
0.169	0.024	0.187	0.023	0.991	-0.001	0.023	41.986
0.210	0.030	0.208	0.030	0.990	-0.002	0.030	41.881
0.182	0.036	0.180	0.036	0.991	-0.001	0.036	42.759
				0.992	0.001		41.768
							= ΔH _o Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from 0.990 to 1.010.
Note: For ΔH_o, orifice pressure differential that equals to 0.75cm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance from the average is ±0.2inches (5.1mm) H₂O

Pass/Fail Result:

Pass

Signature

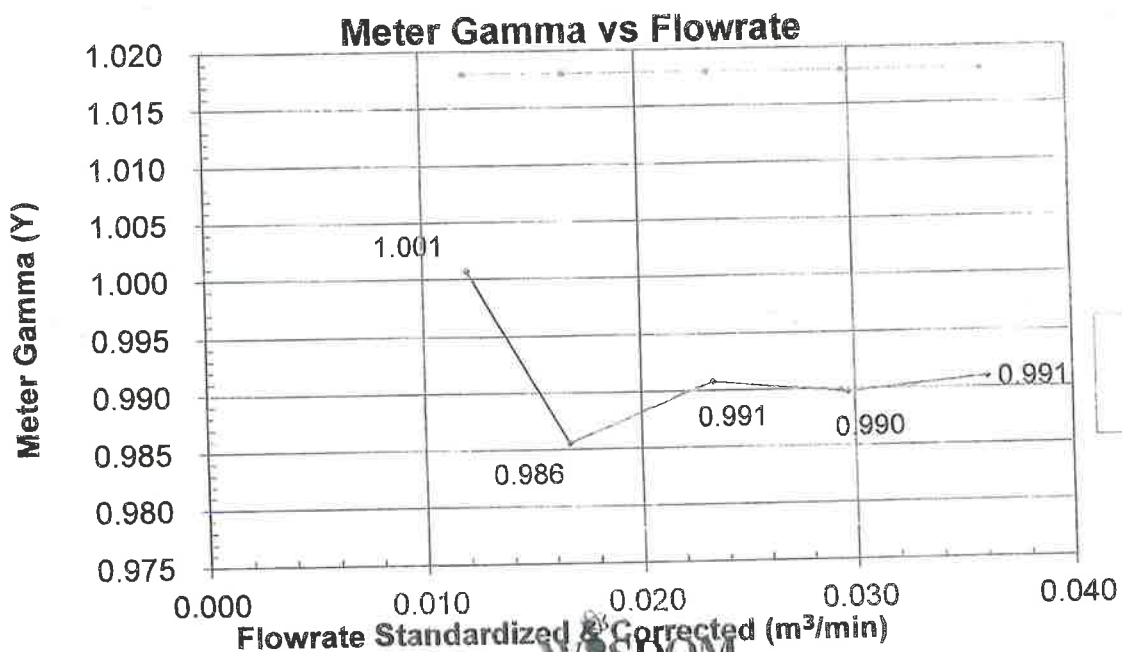
(Palpasu Chaisana)
Service Engineer

บริษัท วิทยาศาสตร์ ขายและบริการ จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date

11/06/2021

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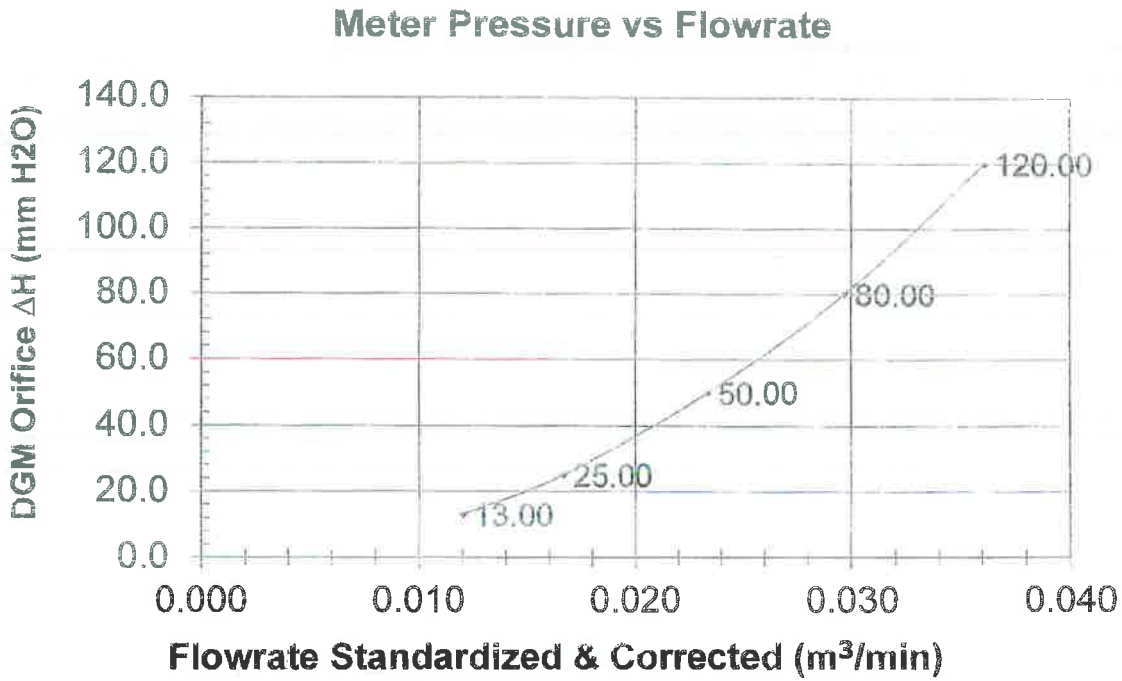


Console Serial: 1110070

Console Model: XC-572V

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Console Serial: 1110070

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 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY (PVT) LTD.

Console Model: XC-572V

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THERMOCOUPLES SYSTEM CALIBRATION

WISDOM

335, Rama 9 Road, 10th Floor, 10110, Bangkok, Thailand
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572V	Calibration Reference No.	WDS-SV650004
Console Serial Number	1110070	Ambient Temp	25.4 °C
Meter Box Model Number	JENCO 765	Barometric Pressure	756 mm Hg
Meter Box Serial Number	JC02484	Relative Humidity	55 %
		Reference Thermometer	FLUKE 714
		Serial Number	9038005

Results												
Console Thermocouple Simulator												
Channel and test point		Temperature Reading (°C)										
		-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack		-18	24	37	92	150	261	373	485	596	821	1045
Probe		-18	24	37	92	150						
Filter		-18	24	37	92	150						
Aux		-18	24	37	92	150						
Exit		-18	24	37								

Tolerance Range
 Stack ± 1.50% Absolute
 Probe ± 3.0 °C
 Filter ± 3.0 °C

Meter ± 3.0 °C
 Exit ± 2.0 °C

Signature

(Patpasu Chaisana)
Service Engineer

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DRY GAS METER MC-572V

Serial No. : 1007055

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m³)

Motor Console Information

Model #: MC-572V
Serial #: 1007055
DGM Model #: SK25EX
DGM Serial #: 00006432

Calibration Condition

Calibration Date: 27/07/2022
Calibration Ref.: WDS-SV650005
Ambient Temp (°C): 23.5
Pressure (mm Hg): 756
Relative Humidity (%): 60

Factors/Conversion

Std. Temp. (°K): 298
Std. Pressure (mm Hg): 760
K₁ (K/mm Hg): 0.3857

Reference Equipment

WTM Model: W-NK0a-5B TM Cal. Due Date: Feb. 2022
WTM Serial: 546298 Gamma: 0.9980

UUT Meter (DGM)				Reference Meter (WTM)					
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial V _{in}	Final V _{in}	Initial T _{in}	Final T _{in}	Initial V _{ref}	Final V _{ref}	Initial T _{ref}	Final T _{ref}
15.00	13.0	0.0025	0.1685	25	25	307.83244	307.98616	25	25
10.00	25.0	0.1910	0.3499	25	25	308.60127	308.15897	25	25
8.00	50.0	0.3711	0.5509	25	25	308.16244	308.34119	25	25
7.00	80.0	0.5844	0.7661	25	25	308.34877	308.55037	25	25
5.00	120.0	0.8310	1.0074	25	25	308.59261	308.77072	25	25

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH_0 (mm H ₂ O)	
Std. Volume V _{std} (m ³)	Std. Flow Rate Q _{std} (m ³ /min)	Std. Volume V _{ref} (m ³)	Std. Flow Rate Q _{ref} (m ³ /min)	"Gamma" (Y)	Variation (ΔY)	Std & Corr Q _{corrected} (m ³ /min)	ΔH_0	Variation $\Delta \Delta H_0$
0.163	0.011	0.160	0.011	0.983	-0.005	0.011	50.865	3.735
0.156	0.016	0.154	0.015	0.985	-0.002	0.015	46.980	0.030
0.177	0.022	0.174	0.022	0.987	-0.001	0.022	46.834	-0.098
0.198	0.028	0.197	0.028	0.990	0.001	0.028	45.368	-1.564
0.175	0.035	0.174	0.035	0.996	0.008	0.035	44.824	-2.106
				0.988	$\pm Y$ Avg.		46.930	$\sim \Delta H_0$ Avg

Pass/Fail Result: Pass

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02

Note: For ΔH_0 orifice pressure differential that equates to 0.75cm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O

Signature

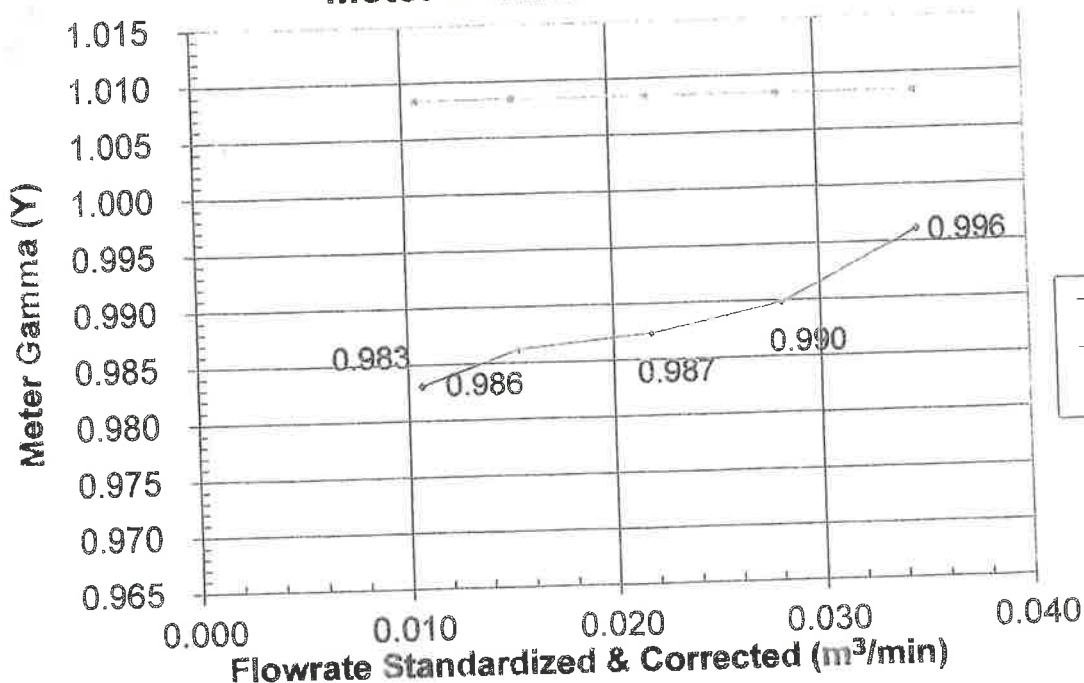
(Patpasu Chaisana)
Service Engineer

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date

27/07/2022

Meter Gamma vs Flowrate



W SDOM

Unit: Meter, bar and mm Hg
WSDOM-572V MC-572V DIGICON N/A

Sampling System Equipment Information	
Console Model Number	MC-572V
Console Serial Number	1007055
Meter Box Model Number	DIGICON
Meter Box Serial Number	N/A

THERMOCOUPLES SYSTEM CALIBRATION

Calibration Conditions	
Date	27/07/2022
Time	9:30 AM
Calibration Reference No.	WDS-SV650005
Barometric Pressure	756 mm Hg
Reference Thermometer	FLUKE 714
Serial Number	9038005

Results	
Console Thermocouple Simulator	
Meter Box Channel Temperature Reading (°C)	
Channel and test point	
Stack	-18.0 25.0 38.0 93.0 149.0 260.0 371.0 482.0 593.0 816.0 1038.0
Probe	-18 25 38 93 150 261 373 485 596 821 1045
Filter	-18 25 38 92 150
Aux	-18 25 38 92 150
Exit	-18 25 38

ance Range
Stack
Probe
Filter

± 1.50% °K
± 3.0 °C
± 3.0 °C

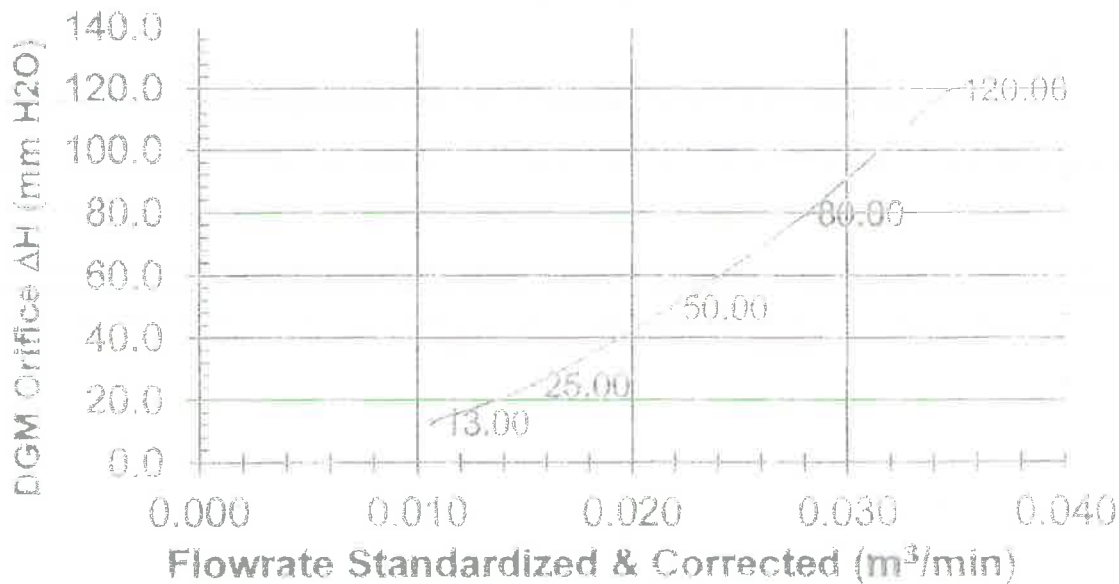
Meter
Exit

± 3.0 °C
± 2.0 °C

Signature

(Palpasu Chaisana)
Service Engineer

Meter Pressure vs Flowrate



Console Serial:

1007055

Console Model:

MC-572V

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DRY GAS METER MC-572V

Serial No. : 0504003

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

Meter Console Information
Console Model : MC572V
Console serial : 0504003
DGM Model #: SK25EX
DGM Serial #: 0009854

Calibration Condition
Calibration Date: 3-Apr-23
Issue Date: 3-Apr-23
Cal. Report No.: WDS-SV660039
Ambient Temp (°C): 25
Pressure (mm Hg): 758
Relative Humidity (%): 60

Factors/Conversion
Std. Temp (°K): 298
Std. Pressure (mm Hg): 760
K₁ (K/mm Hg): 0.3857


Reference Equipment
WTM Model: W-NKoDa-5B
WTM Serial: 600245
WTM Cal. Due Date: Nov. 2022
Gamma: 1.0000

UUT Meter (DGM)						Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
0	P _{min}	V _{in}	V _{out}	t _{in}	t _{out}	V _{in}	V _{out}	t _{in}	t _{out}
15.00	13.0	2.1249	2.2873	26	26	11.24924	11.40853	25	25
10.00	25.0	1.9384	2.0964	26	26	11.06645	11.22136	25	25
8.00	50.0	1.7294	1.9105	26	26	10.86093	11.03905	25	25
7.00	80.0	1.4887	1.6921	26	26	10.62322	10.82407	25	25
5.00	120.0	1.1950	1.3736	26	26	10.33100	10.50914	25	25

Standardized Data						Calibration Results		
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
V _{test} (m ³)	Q _{test} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{calculated}	ΔH ₀	ΔΔH ₀
0.159	0.011	0.156	0.010	0.983	-0.001	0.010	52.990	5.531
0.155	0.015	0.152	0.015	0.981	-0.002	0.015	47.989	0.540
0.178	0.022	0.175	0.022	0.982	-0.002	0.022	46.666	-0.763
0.200	0.029	0.197	0.028	0.983	-0.001	0.028	45.249	-2.210
0.177	0.035	0.175	0.035	0.989	0.006	0.035	44.361	-3.098
				0.984	= Y Avg		47.459	= ΔH@ Avg

Pass/Fail Result: **Pass**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02
Note: For ΔH₀, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O

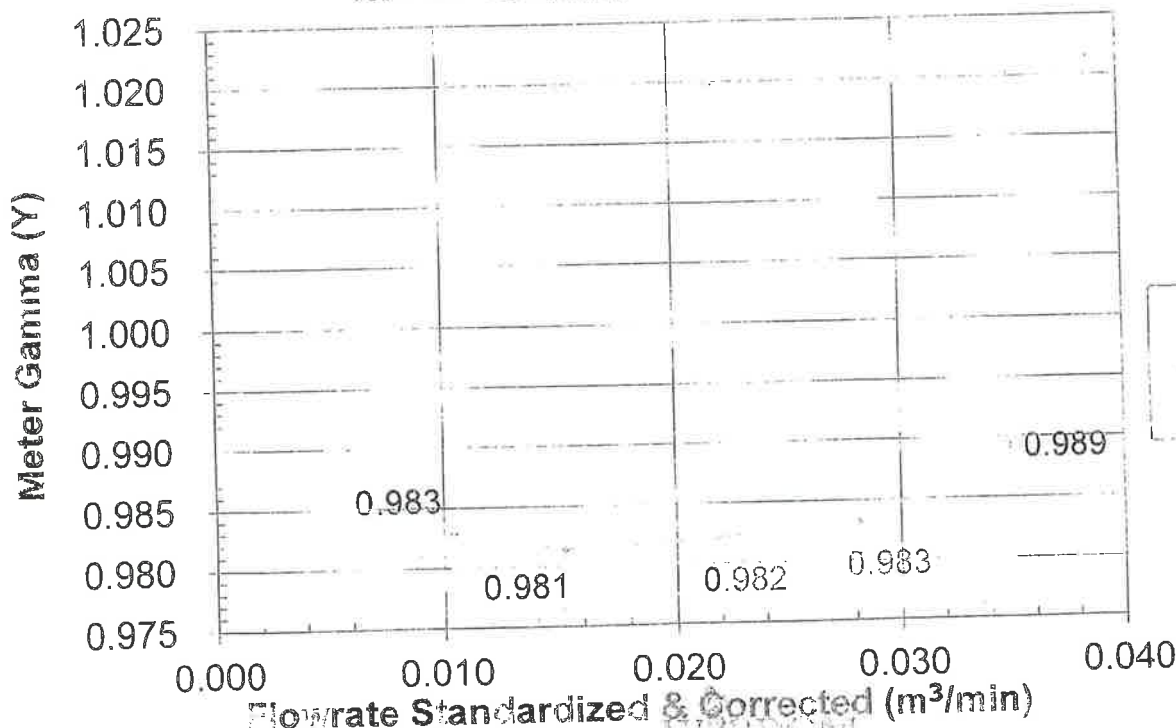
Approved By: 
(Patpasu Chaisana)
Service Manager

WISDOM SCIENCE
WISDOM SCIENCE SALES AND SERVICE GROUP COMPANY LIMITED

Date: 3-Apr-23

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Meter Gamma vs Flowrate

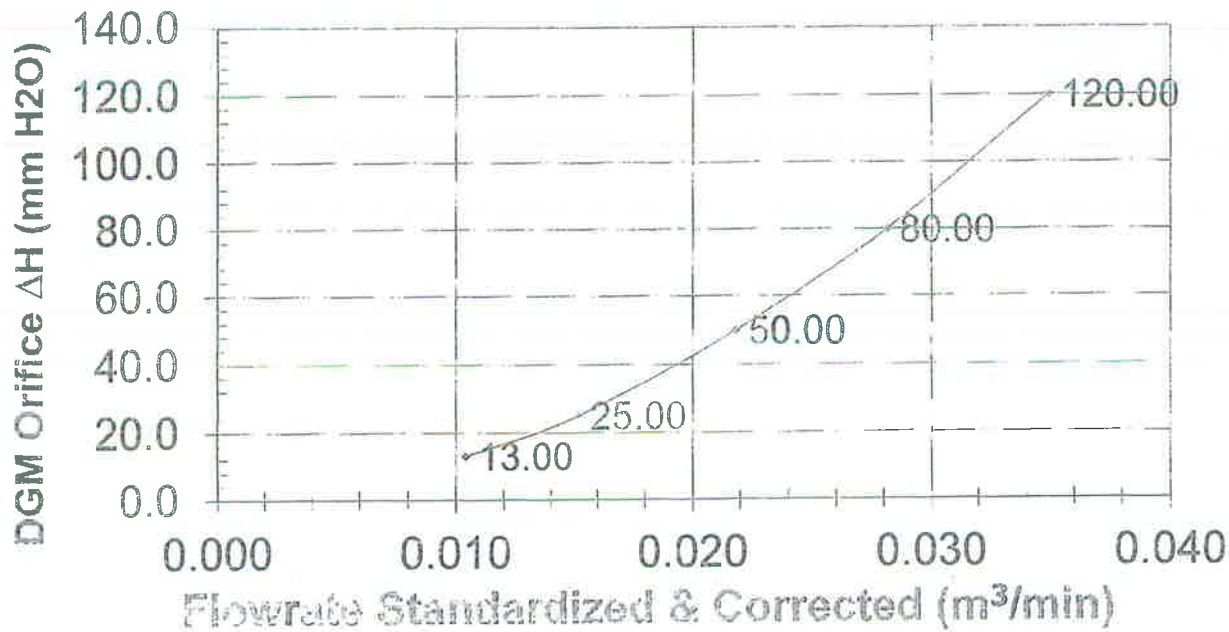


Console Serial: 0504003

Console Model: MC572V

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Console Serial: 0504003

Console Model: MC572V

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information		Calibration Conditions		Reference Equipment	
Console Model:	MC572V	Cal. Date:	3-Apr-23	Temp. Simulator Model:	FLUKE 714B
Console Serial:	0504003	Issue Date:	3-Apr-23	Serial No.	60590035
Temp. Indicator Model:	765-KF	Cal. Report No.:	WDS-SV660039		
Temp. Indicator Serial:	JC17852	Ambient Temp. (°C):	25		
		Pressure (mm Hg):	758		
		Humidity (%):	60		

Temperature Sensor Calibration		
Reference Point	Ref. Thermometer Temperature	Temperature Difference
#	°C	°C
1	-18.0	1.0
2	38.0	1.0
3	93.0	1.0
4	149.0	1.0
5	260.0	1.0
6	371.0	-1.0
7	482.0	0.0
8	593.0	-1.0
9	816.0	0.0
10	1038.0	0.0
Maximum		1.0

Note
For valid test results, the maximum difference between temperature readings should $\leq \pm 1.0^\circ\text{C}$ (EPA Method 5, Section 6.1.1.8)
Perform all TC Channel calibrations, Except meter (DGM) channel

PASS

DGM Out Temperature Sensor Calibration		
Temperature point	Ref. Thermometer Temperature	Temperature Difference
#	°C	°C
Ambient	26.5	0.5
Heat	100.5	-1.5

PASS

Approved By:
(Patras Chaisena)
Service Manager

COPY

For Meter, Sensor, and Instrument used in this report, the calibration is valid until 31-Mar-24. The calibration is performed by WISDOM SCIENCE.

DRY GAS METER XC-572-OV

Serial No. : A2204323



WISDOM SCIENCE

SALE AND SERVICE GROUP COMPANY LIMITED

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m)

Meter Console Information

Console Model : XC-572-OV
 Console serial : A2204323
 DGM Model #: SK26EX
 DGM Serial #: 00008294

Calibration Condition

Calibration Date: 2-May-2023
 Due Date: 1-May-2024
 Cal. Report No.: WDS-SV660066
 Ambient Temp (°C): 25
 Pressure (mm Hg): 758
 Relative Humidity (%): 55

Factors/Conversion

Std. Temp. (°K): 298
 Std. Pressure (mm Hg): 760
 K₁ (K/mm Hg): 0.3857

Reference Equipment

WTM Model: W-NKoDa-5B
 WTM Serial: 800245
 WTM Cal. Date: 22-Nov-2022
 Gamma: 1.0000

UUT Meter (DGM)						Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
9	P _{total}	V _{in}	V _{out}	t _{in}	t _{out}	V _{in}	V _{out}	t _{in}	t _{out}
15.00	13.0	18.0685	18.2252	25	26	17.55844	17.71573	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73837	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6456	18.8344	25	27	18.13775	18.32707	25	25
5.00	120.0	18.8839	19.0510	25	27	18.37705	18.54528	25	25

Standardized Data

Test Meter		Reference Meter		Correction Factor		Flow Rate		
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
V _{std} (m ³)	Q _{std} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{std} (m ³ /min)	ΔH _e	ΔΔH _e
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437	3.293
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528	-0.616
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086	-1.058
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928	-0.216
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741	-1.403
				1.001	= Y Avg.		51.144	= ΔH _e Avg.

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance is ±0.02.
 Note: For ΔH_e, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Pass/Fail Result:

PASS

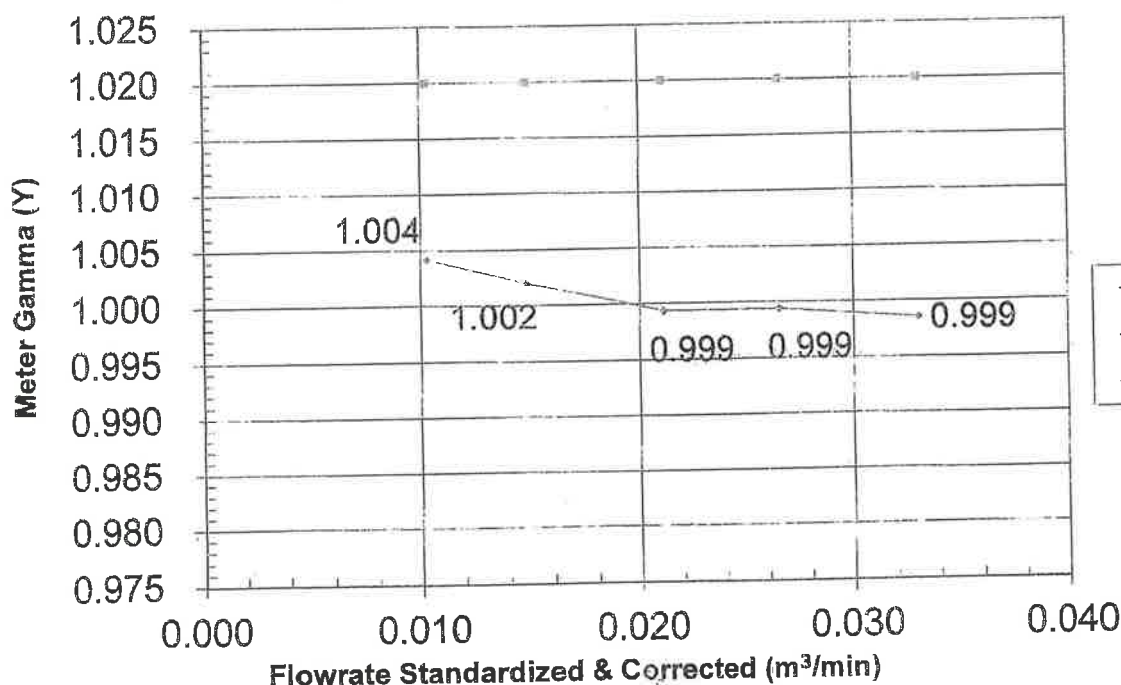
Approved By:

(Palpasu Chaisana)
 Service Manager

WISDOM SCIENCE
 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 2-May-2023

Meter Gamma vs Flowrate



Console Serial:

A2204323

Console Model:

XC-572-OV

WISDOM SCIENCE

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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WISDOM SCIENCE

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model : XC-572-OV
Console Serial : A2204323
Temp. Indicator Model : 765-KF
Temp. Indicator Serial : JC19022

Calibration Conditions

Cal. Date : 2-May-2023
Due Date : 1-May-2024
Cal. Report No. : WDS-SV660066
Ambient Temp. (°C) : 25
Pressure (mm Hg) : 758
Humidity (%) : 55

Reference Equipment

Temp. Simulator Model : FLUKE 714B
Serial No. : 80580035
Calibration Date : 14-Feb-2023

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	25.0	25.0	0.0
3	90.0	90.0	0.0
4	120.0	120.0	0.0
5	250.0	249.0	1.0
6	380.0	380.0	0.0
7	500.0	500.0	0.0
8	620.0	620.0	0.0
9	740.0	739.0	1.0
10	860.0	860.0	0.0
Maximum ¹			1.0

Note

¹ For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.8).
*perform AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

PASS

DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#	°C	°C	°C
Ambient	28.8	29.0	-0.2
Heat	100.0	101.3	-1.3

Difference Rang

DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

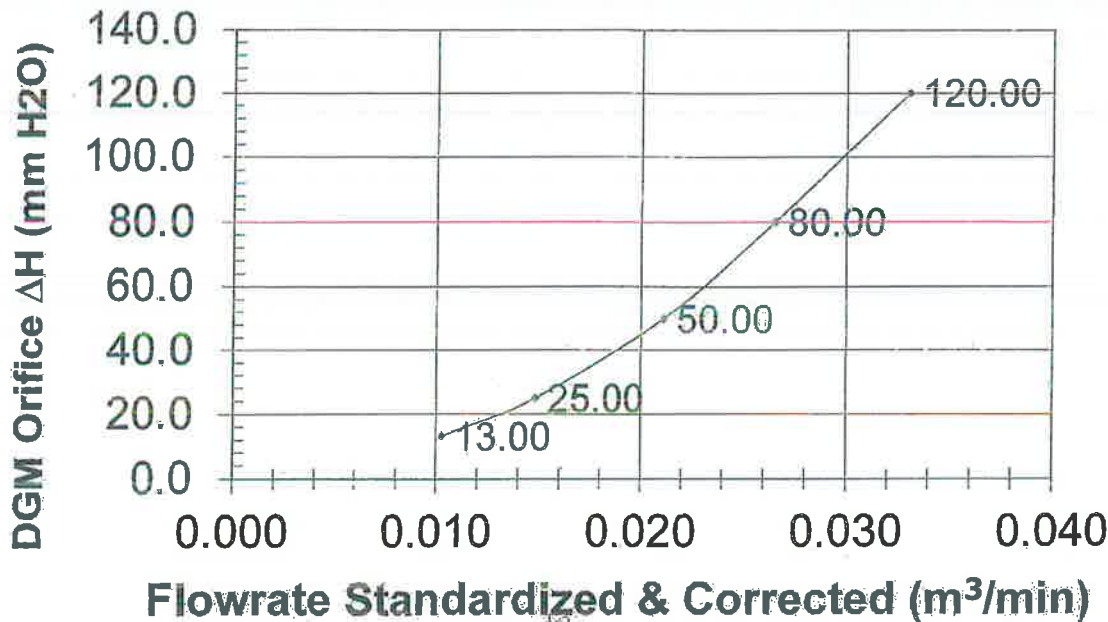
Approved By :

Service Manager
(Paradisi Chaisalee)

บริษัท วิสโดม ไซนส์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

COPY

Meter Pressure vs Flowrate



Console Serial:

A2204323

WISDOM
SCIENCE

Console Model:

XC-572-OV

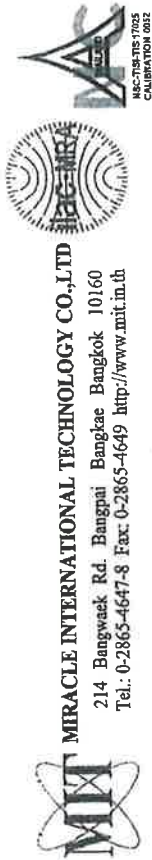
บริษัท วิสโดม ไซนส์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

COPY

Differential Pressure Meter

Testo 510

Serial No. 51501728/004



CALIBRATION CERTIFICATE

Certificate No. : L202208422-001
Date Issued : 07-Sep-22

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukhaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Differential Pressure Meter

Manufacturer : Testo
Model : 510
Serial No. : 51501728/004
ID No./Tag No. : -
Date Received : 01-Sep-22
Date Calibrated : 07-Sep-22
Calibrated by : Mr. Saruth Srichutikul

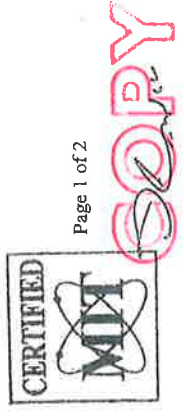
Calibration Method or Calibration Procedure Used
In-house method : CP-07 base on DKD-R 6-1: Edition 3 2014.

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

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

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

Approved by:
(Mr. Sarayuth Tochua)



Certificate No : L202208422-001
Environment : Ambient Temperature : (25 ± 2)°C
Relative Humidity : (50 ± 15)%RH

UUC Reading		STD Reading (inH ₂ O)		UUC Error	Uncertainty
inH ₂ O	Before Adjusted	After Adjusted	inH ₂ O	± inH ₂ O	
0.00	0.0000		0.0000	0.12	
10.00	10.0024		-0.0024	0.12	
20.00	20.0068		-0.0068	0.12	
30.00	30.0025		-0.0025	0.12	
40.00	40.0041		-0.0041	0.12	

STD = Standard

UUC = Unit Under Calibration

Calibrated condition : Pressure Medium : Air : Density = 1.19 kg/m³ @ 20°C, 1 bar
Mounting Position : Vertical
Reference Level : at the end of pressure port
Conversion Factor : Multiply by 2.490 889 E+02 - Pa unit

Description of UUC :
Range : 0 - 40 inH₂O
Calibration Range : 0 - 40 inH₂O
Resolution : 0.01 inH₂O

Condition As-Received : Used Item
The measurement results and statements of conformity with specification only relate to the item calibrated.
Measurement Standards Used & Traceability :
The International System of Units (SI) through
NIMT Certificate No. MP-0138-21 for Digital Manometer Serial No. 2652GA559, Due 09-Sep-22

End of Certificate

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182



REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 Ref		
104	103.5	103.5	104.10	104.08	103.87	103.99	104.08	104.08	103.96	104.01	103.84	0.47	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104.0	0.08	0.32	0.39

Notes

UUC* = Unit Under Calibration

CERTIFICATE OF CALIBRATION

Certificate No. : 23-006679

Sample Code : 23-02820-002

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NSC-TISL1517025
CALIBRATION 0152

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Certificate No. : 23-006679

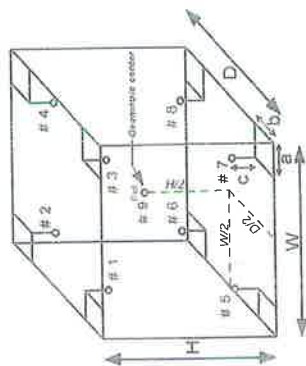
Sample Code : 23-02820-002

REPORT OF CALIBRATION

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

Figure: Example of sensor
installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

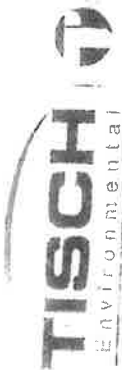
- End of Report -

COPY

ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320



TISCH ENVIRONMENTAL, INC.
143 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
44102
513.467.9000
877.263.7810 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 24, 2016 Rootmeter S/N 0438320 Ta (K) - 295
Operator Tisch Orifice I.D. - 0136 Pa (mm) - 742.95

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORIFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3400	3.2	2.00
2	NA	NA	1.00	0.9510	6.3	4.00
3	NA	NA	1.00	0.8510	7.8	5.00
4	NA	NA	1.00	0.8130	8.6	5.50
5	NA	NA	1.00	0.6690	12.6	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9832	0.7337	1.4054	0.9957	0.7430	0.8911
0.9791	1.0296	1.9875	0.9915	1.0426	1.2603
0.9770	1.1481	2.2221	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7823
Qstd slope (m) =	1.96262		Qa slope (m) =	1.22896	
intercept (b) =	-0.03249		intercept (b) =	-0.02060	
coefficient (r) =	0.99993		coefficient (r) =	0.99993	
y axis = SQRT[H2O(Pa/760)(298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

$$Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)$$

$$Qstd = Vstd/Time$$

$$Va = Diff Vol [(Pa-Diff Hg)/Pa]$$

$$Qa = Va/Time$$

For subsequent flow rate calculations:

$$Qstd = 1/m \{ [SQRT(H2O(Pa/760)(298/Ta))] - b \}$$

$$Qa = 1/m \{ [SQRT H2O(Ta/Pa)] - b \}$$

COPY

Primary Flow Calibrator

Serial No. : 110619 , 207510

Certificate No : 23-AFM-022
 Request No : Req-2023-0128

Certificate of Calibration

Customer
 Name : Eastern Thai Consulting 1992 Co., Ltd.
 Address : 682 Moo 11, Sukhaphum 8 Rd., Nongkham, Sriracha, Chonburi 20230

Unit Under Calibration Details
 Measurement Item : Primary Flow Calibrator
 Manufacturer : BIOS
 Model : Defender 510-L
 Serial Number : 110619
 ID : -
 Location of Calibration : LAB 4 AIR VELOCITY METER

Sensor Model : -
 Sensor Serial Number : -

Calibration Environment and Details
 Temperature : 23 °C ± 3 °C
 Humidity : 55 %RH ± 20 %RH
 Barometric Pressure : 1013 hPa ± 10 hPa
 Received Date : 20 January 2023
 Calibration Date : 6 February 2023
 Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	15 June 2023
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

Traceability :
 This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)
Note :
 The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibration By : Mr. Noppadon Luangrat
 Service Calibration Engineer

Approved By : Mr. Paet Mathavom
 Calibration Engineer Supervisor

Issue Date : 6 February 2023

Result of Calibration :

Flow Setting (L/min)	STD Flow Reading (L/min)	UUC Flow Reading (L/min)	Correction Flow (L/min)	Uncertainty (L/min)
0.02	0.02018	0.020259	-0.00008	0.00032
0.05	0.05041	0.050541	-0.00013	0.00083
0.1	0.1025	0.10153	0.0010	0.0015
0.25	0.2519	0.25043	0.0015	0.0036
0.5	0.5023	0.50069	0.0016	0.0072

Note
 STD : Standard
 UUC : Unit Under Calibration

End of Certificate

COPY

Certificate of Calibration

Customer
 Name : Eastern Thai Consulting 1992 Co., Ltd.
 Address : 683 Moo 11, Sukhapibarn 8 Rd., Nongkham, Sracha, Chonburi 20230

Certificate No : 23-AFM-024
 Request No : Req-2023-0196

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
 Manufacturer : Mesa Labs
 Model : Defender 510-M
 Serial Number : 207510
 ID : -
 Sensor Model : -
 Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
 Humidity : 55 %RH ± 20 %RH
 Barometric Pressure : 1013 hPa ± 10 hPa
 Received Date : 25 January 2023
 Calibration Date : 6 February 2023

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of

Units (SI)

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Result of Calibration :

Calibration Point	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty (±)
(cc/min)	(cc/min)	(cc/min)	(cc/min)	(cc/min)
500	501.1	506.43	-5.3	7.2
1000	1019	1032.2	-13	13
2000	2003	2017.8	-15	29
3000	3007	3023.8	-17	43
4000	4013	4027.2	-15	57

Note

STD Standard

UUC : Unit Under Calibration

End of Certificate

Calibration By : Mr. Noppadon Luangart
 Service Calibration Engineer

Approved By : Mr. Pacit Mathavorn
 Calibration Engineer Supervisor

Issue Date : 6 February 2023

COPY

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



NSC-TSI-TS17025
CALIBRATION 0152
Page 1 of 2

Certificate No. : 22-068062
Sample Code : 22-24591-002

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Siracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration laboratory)

Equipment : Digital thermo-hygrometer

Manufacturer : testo

Model : 608-H1

Serial No. : 45106737

ID No. : LABC 09/7

Date of Receipt : 22 June 2022

Date of Calibration : 24 June 2022

Condition of Calibration

1. Environment
 - 1.1 Ambient temperature : 23.0 °C ± 3.0 °C
 - 1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method

- 2.1 In-house method: WI-CL-045 By comparison with thermometer standard / chilled mirror hygrometer in controlled chamber.
- 2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer in a chamber at the controlled temperature / relative humidity.

3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew Vision	LB-DP-01 & LB-DP-01 (DP)	TH-0014-22	16 February 2023
3.2 Digital Thermometer	Optidew Vision	LB-DP-01 & LB-DP-01 (Temp.)	22-025549	14 March 2023
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	21-072473	13 September 2022

4. This certificate is traceable to the international system of unit (SI Unit).

- 4.1 Instrument No. 3.1 through National Institute of Metrology (Thailand).
- 4.2 Instrument No. 3.2 and 3.3 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by : Miss Pomsuda Lohabai
Approved by : (Mr. Somchai Neampun)
Scientist : Signed for Director

Issue date : 27 June 2022

The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards, and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
Rev 01

TEL 02-516-2422
FAX 02-516-6949

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date 15/10/21

REPORT OF CALIBRATION

Certificate No. : 22-068062
Sample Code : 22-24591-002

Results of Calibration

Temperature measurement
Resolution : 0.1 °C
Range : 0 °C to 50 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.00	20.2	- 0.20	± 0.39
25	50	25.00	24.9	+ 0.10	± 0.39
30	50	30.00	29.8	+ 0.20	± 0.39

Humidity measurement

Resolution : 0.1 %RH
Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.13	51.4	- 6.27	± 1.3
60	25.00	60.03	66.5	- 6.47	± 1.5
75	25.00	75.20	81.5	- 6.30	± 1.7

Notes

- Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS MD001.

- End of Report -

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Rev 09

TEL 02-516-2422
FAX 02-516-6949

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date 15/10/21

UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



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www.barascientific.com



Bara Scientific
Subsidiary of Bara Co., Ltd.

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No.
Equipment
Model
Manufacturer
Serial No.
ID No.
Date of receipt
Date of calibration
Date of issue

BSCC-UV-167/22
UV/Vis Spectrophotometer
UV-1800
Shimadzu
A11635101643 CD
LABE 03/2
18 May 2022
18 May 2022
25 May 2022

Customer name
Address

Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sirachua, Chonburi 20230,

Temperature
Humidity

(23.8-24.5) °C (On site)
(47.6-48.3) %RH (On site)

Equipment condition

Good Operation

Calibration Location

Analysis Department

Calibration Procedure

In-house method WI-UV-702-01 based on ASTM E275-01

Traceability

Wavelength Accuracy is traceable to certificate No. 96367 and 96366
Photometric Accuracy is traceable to certificate No. 99925 and 100147
96346
Sray Light is traceable to certificate No. 96346
The above certificate are traceable to SI unit through Sarna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 06599)

Calibrated by

Mr.Kanchit Choothep

Approved by

[Signature]

Mr.Kanchit Choothep
Technical Manager

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FM-UV-709.02 Rev.01 (23/07/63)



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Bara Scientific Co., Ltd.
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Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No.
Calibration Results:
1.Wavelength Accuracy

BSCC-UV-167/22

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.80	0.09	0.18
445.82	445.95	0.13	0.18
536.52	536.60	0.08	0.18
741.02	741.00	-0.02	0.18
879.41	879.40	-0.01	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000 0.7311	0.0000 0.7321	0.0000 0.0010	0.0075 0.0075
257	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
350	0.0000 0.6306	0.0000 0.6314	0.0000 0.0008	0.0075 0.0075

*CNR = Customer not request

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FM-UV-708.02 Rev.01 (23/01/63)



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Certificate of Calibration

Certificate No. BSCC-UV-167/22 Number of Page(s) 3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5481	0.0009	0.0042
	0.7637	0.7636	-0.0001	0.0042
	1.0480	1.0487	0.0017	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5377	0.0006	0.0042
	0.7457	0.7451	-0.0006	0.0042
	1.0233	1.0240	0.0016	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5006	0.0000	0.0042
	0.6961	0.6944	-0.0017	0.0042
	0.9563	0.9550	-0.0013	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5137	0.0000	0.0042
	0.6907	0.6891	-0.0016	0.0042
	0.9553	0.9519	-0.0014	0.0042

*CNR = Customer not request

4. Stray Light*

Unit Under Calibration(UJC)		
Standard cut-off wavelength (nm)	Wavelength (nm)	Absorbance (A)
200.9130.11nm	201.10	2.0204
		0.9543

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%

End of Certificate

COPY

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Rev.01 (230163)

UV/VIS SPECTROPHOTOMETER

Model : UV - 1800

Serial No. : A11635101643 CD



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Division of Success

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-152/23
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643 CD
ID No. N/A
Date of receipt 25 April 2023
Date of calibration 25 April 2023
Date of issue 27 April 2023

Customer name Eastern Thai Consulting 1992 Co.,Ltd

Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature (22.4-23.1) °C (On site)
Humidity (44.5-45.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Analysis Department

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability
Wavelength Accuracy is traceable to certificate No. 94780 and 94775
Photometric Accuracy is traceable to certificate No. 94808 and 100147
94791
Stray Light is traceable to certificate No.
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Pannaphong Phannmekakul

Approved by

Signature

Mr.Kanchit Choothep
Technical Manager

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Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-152/23

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.65	-0.06	0.18
445.82	445.80	-0.02	0.18
536.52	536.35	-0.17	0.18
741.02	740.99	-0.03	0.18
879.41	879.27	-0.14	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7311	0.7313	0.0002	0.0075
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6306	0.6314	0.0008	0.0075

*CNR = Customer not request

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Bara Scientific
Solutions & Success

Certificate of Calibration

Certificate No.

BSCC-UV-152/23

Number of Page(s)

3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (\pm A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5488	0.5508	0.0020	0.0042
	0.7527	0.7535	0.0008	0.0042
	1.0756	1.0758	0.0002	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5391	0.5408	0.0015	0.0042
	0.7355	0.7360	0.0005	0.0042
	1.0509	1.0501	-0.0008	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5045	0.5044	-0.0001	0.0042
	0.6884	0.6885	0.0001	0.0042
	0.9816	0.9808	-0.0008	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5183	0.5178	-0.0005	0.0042
	0.6854	0.6868	0.0004	0.0042
	0.9747	0.9739	-0.0008	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.75 \pm 0.11nm	200.72	2.0164

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A
*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor $k=2$ providing a level of confidence of approximately 95%
End of Certificate

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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ANALYTICAL BALANCE

Model. : SECURA224-1S

Serial No. : 0036707137

Certificate No. : 23-006682
Sample Code : 23-02820-005

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriacha, Chonburi 20230
Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Pholthep
Scientist

Issue date : 25 January 2023

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

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

Certificate No. : 23-006682
Sample Code : 23-02820-005

REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Capacity : Max 220 g

Resolution : 0.0001 g

Serial No. : 0036707137

ID No. : LABE 05/2

Result of Calibration

1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g

☐ Before adjustment ☐ After adjustment

Range : 220

Nominal value

100 200

Standard weight

100.000022 200.000199

Average reading of indicator

99.9998 199.9999

Standard deviation

0.00007 0.00007

Unit : g

☐ Before adjustment ☐ After adjustment

Range : -

Nominal value

Standard weight

Average reading of indicator

Standard deviation



Certificate No. 23-006682

Sample Code 23-02820-005

Page 3 of 4

NSC-TS1-TS17025
CALIBRATION 0152

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

Range :	Test Point	Sensitivity, S	Test Point	Sensitivity, S
220	0	0.9980		
	100	0.9980		
	200	0.9980		

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.00011	2.04
0.01	0.0100036	0.0100	0.0000	0.00011	2.04
0.1	0.1000062	0.1000	0.0000	0.00011	2.04
1	1.0000036	1.0000	0.0000	0.00011	2.04
2	2.0000128	2.0000	0.0000	0.00011	2.04
5	5.0000044	5.0000	0.0000	0.00011	2.04
10	10.0000000	10.0000	0.0000	0.00011	2.03
20	20.0000016	20.0000	0.0000	0.00012	2.03
50	50.0000029	50.0000	0.0000	0.00013	2.02
100	100.0000022	99.9998	0.0002	0.00017	2.01
200	200.0000199	200.0000	0.0002	0.00028	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003



Certificate No. 23-006682

Sample Code 23-02820-005

Page 4 of 4

NSC-TS1-TS17025
CALIBRATION 0152

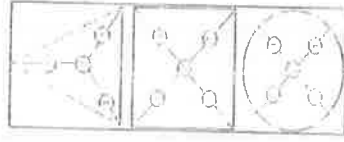
REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

Deviation of the measurement value through off-center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pen support.

Wearing pan	Test weight : 100
<input checked="" type="radio"/> Circle	Unit : g
<input type="radio"/> Triangular	
<input type="radio"/> Rectangular	
Range	220
Position	Reading of indicator
1	99.9998
2	100.0001
3	99.9997
4	99.9998
5	99.9998
6	99.9998
Maximum difference	0.0003



Condition of Calibration

1. Calibration Method : WI-QL-004 base on UKAS LAB 14: 2019

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

3. Condition of Calibration Item: Normal

4. This certification is traceable to the International System of Unit maintained at : -
Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

5. Reference standard instrument :

Instrument

1) STANDARD WEIGHT 1 mg to 1 kg

Class E2

ID No. LE-WE-57

Certificate No. 22-080639

Due Date 27 June 2023

End of Report

BOD INCUBATOR

ID No. : LABE 19/2



NSC-TSI-TSI17025
CALIBRATION 0132
Page 1 of 3
22-136844
22-51164-006

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhaphan 8 Rd., Nongkham,
Sriacha, Chonburi 20230
Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (Incubator)
Manufacturer : N/A
Model : N/A
Serial No. : SS40040277
ID No. : LABE 19/2
Date of Receipt : 21 December 2022
Date of Calibration : 21 December 2022

Condition of Calibration

1. **Environment**
1.1 Ambient temperature : Maximum 25.1 °C : Minimum 24.3 °C
1.2 Relative humidity : Maximum 52.3 % : Minimum 48.5 %
1.3 Line voltage supplied : Maximum 223.6 VAC : Minimum 221.9 VAC

2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument : ID No. : Certificate No. : Due Date :
Date Acquisition With Sensor : LB-DA-11 (RTD-148 to RTD-155, RTD-227) : 22-040308 : 24 April 2023

4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Nathanan Phosri

Approved by

(Mr. Somchai Naampunt)
Signed for Director

Issue date

26 December 2022

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

The calibration result is added only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has stated the measurement capability of the laboratory and its measurability in recognized national standards and to the unit of measurement related to the corresponding national standards (AMARC).

Herewith we state in this certificate with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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Phlabphla, Wang Thonglang, Bangkok 10310
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Rev 01
Effective Date 15/10/21



NSC-TSI-TSI17025
CALIBRATION 0132
Page 2 of 3
22-136844
22-51164-006

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

1. Reporting of Temperature													
Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# 9 nd
20	20.0	20.0	19.65	19.56	19.47	19.29	20.96	20.47	20.23	20.58	20.29	0.35	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.13	1.09	1.90

Notes

UUC* = Unit Under Calibration



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FAX 02-516-6949
Rev 09
Effective Date 15/10/21



REPORT OF CALIBRATION

Certificate No. : 22-136844

Sample Code : 22-5164-006

Results of Calibration

Notes

1. Sensor installation locations

1.1 All sensors at any corners or walls should be positioned

5 cm (a x b x c) from the wall.

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

2. Interior dimensions approx of chamber :

W = 80 cm ; D = 70 cm ; H = 124 cm

3. Air valve or fresh air level : Off

4. Fan level : open

5. The quoted uncertainty includes: Stability of chamber and loading effect in chamber at 20% of uniformity "

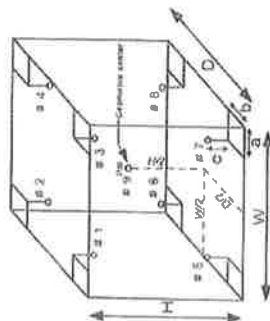
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

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

8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.

9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure

10. Calibration results without adjustment.

Figure: Example of sensor
installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M0003.

- End of Report -

BOD INCUBATOR

ID No. : LABE 19/5



Page 1 of 3
Certificate No. : 23-040768
Sample Code : 23-16178-002

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriacha, Chonburi 20230
Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (Incubator)
Manufacturer : Lovibond
Model : Tc445S
Serial No. : 0520/005527
ID No. : LABE 19/5
Date of Receipt : 21 April 2023
Date of Calibration : 21 April 2023

Condition of Calibration

1. Environment
1.1 Ambient temperature : Maximum 36.1 °C Minimum 34.5 °C
1.2 Relative humidity : Maximum 51.8 % Minimum 49.3 %
1.3 Line voltage supplied : Maximum 224.7 VAC Minimum 221.9 VAC

2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-PT100)	LB-DA-08 (RTD-239 to RTD-247)	22-077888	09 August 2023

4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Sarawoot Thammo

Scientist

24 April 2023

Issue date

Approved by

(Mr. Somchai Neampunt)

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

The calibration result is issued only to the above calibrated item and was found accurate as shown on date and place of calibration only.
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and is traceable to recognized national standards, and in the unit of measurement calibrated at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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Rev. 01
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WWW.AMARC.CO.TH
Effective Date 15/03/21



REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k
		# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8		
20	20.0	20.06	19.92	19.96	19.89	19.93	20.06	19.97	19.86	0.42	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.32	0.37	0.85

Notes

* UUC* = Unit Under Calibration



REPORT OF CALIBRATION

Page 3 of 3
Certificate No. : 23-040768
Sample Code : 23-16178-002

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of this chamber.
2. Interior dimensions approx of chamber :
W = 60 cm ; D = 56 cm ; H = 146 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

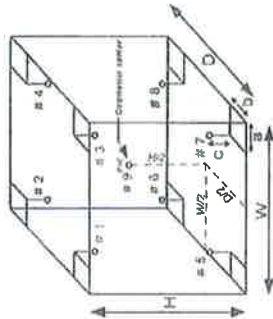


Figure: Example of sensor
installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M2003

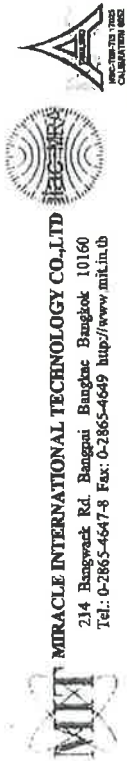
- End of Report -

COPY

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



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



CALIBRATION CERTIFICATE

Certificate No. : L202305085-002
Date Issued : 16-May-23

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukhaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Analog Barometer

Manufacturer : Barigo
Model : -
Serial No. : -
ID No./Tag No. : BM001/41
Date Received : 11-May-23
Date Calibrated : 15-May-23
Calibrated by : Mr. Jarnie Khaothong

Calibration Method or Calibration Procedures Used

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

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

Result of Calibration

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

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



Approved by: *Sorayuth T.*
(Mr. Sarayuth Tochua)

Page 1 of 2

COPY

Certificate No : L202305085-002

Environment : Ambient Temperature (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading	UUC Reading (mbar)	UUC Reading (mbar)	UUC Error	Uncertainty
mbar	Before Adjusted	After Adjusted	mbar	± mbar
990.00	990.0	*	0.00	0.61
1000.00	1000.0	*	0.00	0.61
1010.00	1010.0	*	0.00	0.61
1020.00	1020.0	*	0.00	0.61
1030.00	1030.0	*	0.00	0.61

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium : Air : Density = 1.19 kg/m³ @ 20°C, 1 bar
Mounting Position : Vertical
Reference Level : at center of its dial
Conversion Factor : Multiply by 1.0 E+02 - Pa unit

Description of UUC :

Range : 990 - 1030 mbar Absolute
Calibration Range : 990 - 1030 mbar Absolute
Scale Interval : 1 mbar
Resolution : 0.5 mbar Absolute

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P220104 for Reference Pressure Monitor Serial No. 1598, Due 11-Nov-23

End of Certificate

Page 2 of 2

COPY

GAS CHROMATOGRAPH

Model. : GC-2010 PLUS AF

Serial No. : C12095200986

Operational Qualification

Operational Qualification Record

3. Operational Qualification Record

If the unit is included in the system to be inspected, place a checkmark in the "Applicable" box. If the unit is not included in the system, place a checkmark in the "Not Applicable" box. Enter a diagonal line in the Pass/Fail checkbox for "Not applicable" items.
Here, inspection results are recorded along the procedure of Chapter 4 in Operational Qualification Protocol.

3-1 Gas Chromatograph GC-2010Plus

☒ Applicable ☐ Not Applicable

Model Name		GC-2010Plus	
Component ID		Gas Chromatograph L80E 09/13	
Serial Number (SN)		C 1 2 0 9 5 2 0 0 9 3 6	
No.	Item	Criteria	Results
1	Display, LED test	Verify the display and LED operation. Screen contrast adjustment is possible.	LED Display <input checked="" type="checkbox"/>
2	Standard self-diagnostic test	"Good" displayed as the result of the self-diagnostic test.	Good <input checked="" type="checkbox"/>
3	Firmware version check	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. 2.1040 Build No.: 2.1040 Ver. 2.1040 Build No.: 2.1040 <input checked="" type="checkbox"/>
4	Temperature test	Verify that temperature control is normal. TEMP LED lights green.	Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$. Temperature controller (Name) Measured value COOL (Colony) 50.0°C 50.0°C IN1 (SRI) 50.0°C 50.0°C IN2 50.0°C 50.0°C DET1 50.0°C 50.0°C DET2 50.0°C 50.0°C AUX3 50.0°C 50.0°C AUX4 50.0°C 50.0°C AUX5 50.0°C 50.0°C <input checked="" type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure. Inspection pressure gauge reading 10.0 to 3.0 kPa Post-correction reading 9.9 kPa Inspection pressure gauge reading 20.0 to 20.0 kPa Post-correction reading 20.0 kPa Inspection pressure gauge reading 35.0 to 35.0 kPa Post-correction reading 34.9 kPa	Pressure gauge correction value 0.1 kPa Pressure gauge reading 9.9 kPa Post-correction reading 9.9 kPa Pressure gauge correction value 0.5 kPa Pressure gauge reading 20.1 kPa Post-correction reading 20.0 kPa Pressure gauge correction value 0.9 kPa Pressure gauge reading 35.1 kPa Post-correction reading 34.9 kPa <input checked="" type="checkbox"/>

Performer (signature): *Jim* Date: 25 / 07 / 2022
Reviewer (signature): *Jim* Date: 25 / 8 / 22

Operational Qualification

Operational Qualification Record

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Verify that the pressure program operates normally. Monitored pressure 6 minutes after start 250.0 \pm 5.0 kPa Inspection pressure gauge reading 8 minutes after start 250.0 \pm 20.0 kPa	250.0 \pm 5.0 kPa 250.0 \pm 20.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Flowrate test	Verify the accuracy of the full-flow and septum purging. Septum purge vent measured flow rate 3.0 \pm 1.0 mL/min Total of septum purge and split vent flow rate values 10.0 \pm 3.0 mL/min	Septum purge 3.0 \pm 1.0 mL/min Split vent 7.0 \pm 2.0 mL/min Total 10.0 \pm 3.0 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7		Verify the accuracy of the column oven temperature. Inspection temperature sensor displayed value 250.0 \pm 3.0°C Temp. correction value 250.0 \pm 3.0°C Inspection temperature sensor displayed value 250.0 \pm 3.0°C Temp. correction value 250.0 \pm 3.0°C Inspection temperature sensor displayed value 250.0 \pm 3.0°C Temp. correction value 250.0 \pm 3.0°C	Temp. correction value 250.0 \pm 3.0°C Temp. sensor reading 250.0 \pm 3.0°C Corrected temp. value 250.0 \pm 3.0°C Temp. sensor reading 250.0 \pm 3.0°C Corrected temp. value 250.0 \pm 3.0°C Temp. sensor reading 250.0 \pm 3.0°C Corrected temp. value 250.0 \pm 3.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature. Inspection temperature sensor displayed value 250.0 \pm 3.0°C Temp. correction value 250.0 \pm 3.0°C Inspection temperature sensor displayed value 250.0 \pm 3.0°C Temp. correction value 250.0 \pm 3.0°C	Temp. correction value 250.0 \pm 3.0°C Temp. sensor reading 250.0 \pm 3.0°C Corrected temp. value 250.0 \pm 3.0°C Temp. sensor reading 250.0 \pm 3.0°C Corrected temp. value 250.0 \pm 3.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the column temperature program operates normally. Monitored temperature 6 minutes after start 200 \pm 1°C Inspection temperature reading 8 minutes after start 200.0 \pm 4.7°C Using a temperature sensor with 1°C minimum display increment 200 \pm 3°C	Monitored temperature 6 minutes after start 200 \pm 1°C Inspection temperature reading 8 minutes after start 200.0 \pm 4.7°C Using a temperature sensor with 1°C minimum display increment 200 \pm 3°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity. FID () Applicable Not Applicable Calculated S value Inj. unit () Make-up gas: N ₂ 10.0 \times 10 ⁻³ C/g min. Make-up gas: He 7.00 \times 10 ⁻³ C/g min. TCD () Applicable Not Applicable Calculated S value Inj. unit () 4.00 \times 10 ⁻³ mV-mL/mg min.	CiAREA value 61462 Calculated S value 15.60 \times 10 ⁻³ C/g CiAREA value Flowrate at vent Calculated S value	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): *Jim* Date: 25 / 07 / 2022
Reviewer (signature): *Jim* Date: 25 / 8 / 22

SHIMADZU GAS CHROMATOGRAPH SYSTEM
GC-2010Plus Series

Operational Qualification

System Name	
System ID No. Gas Chromatograph LABE 0413	
Installation Site Instrument Room GC/TC	
The undersigned performer reports that the Operational Qualification Protocol has been successfully completed for the system stated above.	
• Performer	
Signature	Date
Print Thannawat Pumsaka	25 / 02 / 2022
Title Service Engineer	
Company Boonscientific Co., Ltd.	
The undersigned reviewer and manager report that the performer has completed the Operational Qualification Protocol successfully.	
• Reviewer	
Signature	Date
Print Wongsak Chaisri	25 / 02 / 2022
Title Scientist	
Company Eastern Thai Consulting 1992 Co., Ltd.	
• Manager	
Signature	Date
Print Nuanphol Bunkhrod	25 / 02 / 2022
Title HS	
Company Eastern Thai Consulting 1992 Co., Ltd.	

Operational Qualification

Definitions

1-2 Scope

This Operational Qualification shall apply to the equipment installed at the following site.

(Address): 551 Moo 11 Sukhaphiban Rd. Nongphay, Siachon Chaborn 20110
(Company): Eastern Thai Consulting 1992 Co., Ltd.
(Department):
(Installation Site): Instrument Room GC/TC
(Equipment ID No.): Gas Chromatograph LABE 0413
(Product Model Name): GC-2010Plus | HOC-201 | POC-201

Performer (signature): [Signature] Date: 25 / 02 / 2022
Reviewer (signature): [Signature] Date: 25 / 02 / 2022

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Applicable ☐ Not Applicable

☒ Single ☐ Dual system, main injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 8 0 9			
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point		Display: 000	Pass
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display: 000	Pass
3	Firmware version check	Verify the program version.		Version No. 3.4.0	Pass
4	Basic operation test	Verify that the auto injector basic operation is correct.		Version No. 3.4.0	Pass

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)					
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display:	Pass
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display:	Pass
3	Firmware version check	Verify the program version.		Version No. 3.4.0	Pass
4	Basic operation test	Verify that the auto injector basic operation is correct.		Version No. 3.4.0	Pass

Performer (signature):

Date: 25 / 02 / 2022

Reviewer (signature):

Date: 25 / 02 / 2022

Rev. 3.31

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 9 1 0			
No.	Item	Criteria		Results	Pass/Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red.	Pass
2	Firmware version check	Verify the program version.		Version number is displayed.	Pass
		The version number matches the controlled version number.		Version No. 3.4.0	Pass

Performer (signature):

Date: 25 / 02 / 2022

Reviewer (signature):

Date: 25 / 02 / 2022

Rev. 3.31

Hot Air Oven

Model. : UM 400

Serial No. : 900982



CERTIFICATE OF CALIBRATION

Page 1 of 3
Certificate No. : 23-018635
Sample Code : 23-07651-001

Customer

EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Siriracha, Chonburi 20230

Location of Calibration

EASTERN THAI CONSULTING 1992 CO., LTD.
(Hot Lab)

Equipment

Temperature controlled enclosures (Hot air oven)

Manufacturer

Model : UM 400

Serial No.

ID No. : LABE 17/1

Date of Receipt

Date of Calibration : 21 February 2023

Condition of Calibration

1. Environment
- 1.1 Ambient temperature : Maximum 31.2 °C : Minimum 28.7 °C
 - 1.2 Relative humidity : Maximum 50.2 % : Minimum 40.1 %
 - 1.3 Line voltage supplied : Maximum 223.9 VAC : Minimum 221.5 VAC

2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-P100)	LB-DA-12 (RTD-158 to RTD-166)	22-040312	02 May 2023

4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Sarawoot Thammo

Scientist

Approved by

Issue date

24 February 2023

Signed for Director

(Mr. Somchai Neamput)

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

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and in the unit of measurement related to the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)



REPORT OF CALIBRATION

Certificate No. : 23-018635
Sample Code : 23-07651-001

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k
			#1	#2	#3	#4	#5	#6	#7	#8		
85	85.0	85.0	85.18	85.04	84.82	85.03	85.04	85.00	84.96	85.08	0.25	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.07	0.48	0.68

Notes

* UUC* = Unit Under Calibration





REPORT OF CALIBRATION

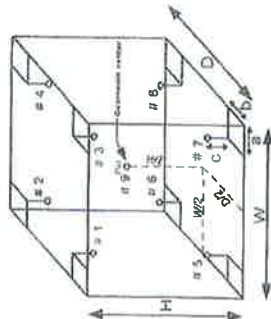
Certificate No. : 23-018635

Sample Code : 23-07651-001

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 40 cm ; D = 28 cm ; H = 39 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

Figure: Example of sensor
Installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M0003

- End of Report -

INDUCTIBELY COUPLED PLASMA SPECTROMETER

Model : Prodigy 7

Serial No. : P70177



บริษัท แอปพลิเคชัน ดีฟายน์ จำกัด
Application Define Company Limited
133/18 ถนนพหลโยธิน แขวงสามยุค เขตปทุมธานี กรุงเทพมหานคร 10510
133/18 Hatayath Road, Minburi Sub-district Minburi District, Bangkok 10510
Tel: (66) 4455-5191 E-mail: support@addefine.co.th Website: http://www.addefine.co.th
โทร: ๐๒-๕๕๕-๕๑๙๑ อีเมล: support@addefine.co.th เว็บไซต์: http://www.addefine.co.th

CERTIFICATE OF INSTRUMENT PERFORMANCE

INSTRUMENT:	INDUCTIVELY COUPLED PLASMA SPECTROMETER	STATUS
	Telodyne Leeman Labs	
BRAND:	Prodigy 7	OK
MODEL:	P70177	OK
SERIAL NO.	บริษัท อีทีพี เทคโนโลยี จำกัด	OK
CUSTOMER:	บริษัท อีทีพี เทคโนโลยี จำกัด	OK
CHECKING:	SPECTROMETER	OK
	Wavelength Accuracy check by use emission line of Hg Lamp Mercury line 253.652 nm. Plasma View (Dual View) OMOS Detector check Align View by Mn line 257.610 nm.	
RF GENERATOR	Incident Power 1,200 ±10 Watt	OK
	Reading = 1,200 Watt	
SAMPLE INTRODUCTION	Plasma Torch, Injector, Spray chamber, Nebulizer	OK
	Partialtic pump & Tubing	
EXHAUSTING & COOLING SYSTEM	Safety Interlock Switch (Door, Argon pressure, Water pressure)	OK
	Cooling System, water flowrate & low pressure switch	
COMPUTER & SOFTWARE	Flowrate of Air blower	OK
	Plasma Ignition software & Analytical Software	
ANALYTICAL TEST	Full Frame Capture & Echogram check	OK
	Calibration Curve & QC Test	

DATE: Dec 12, 2022







Mr. Somchai Chumyung
Engineer Sign

AD

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีพี เทคโนโลยี จำกัด	Date: Dec 12, 2022
Instrument: ICP-OES	Model: Prodigy 7

1. Gas Supply /Water Re-circulator/Exhaust Hood Check:

Gas system: ตรวจระบบแก๊สและน้ำทิ้ง	Leak inspected (✓) No leak Leak inspected (✓) No leak Leak inspected (✓) No leak	
Argon Pressure: 5-10 psi Nitrogen Pressure: 5-10 psi Oxygen Pressure: 5-10 psi		
() Change camera purge gas Dehydrator (1 times /years) Next time replacement 27 Dec 2023 เปลี่ยนแก๊สล้างเลนส์กล้องถ่ายรูป ทุก 1 ปี		
Water Chiller: RF generator flow rate 4.44 LPM Temperature 25 °C ตรวจอุณหภูมิ Leak inspected (✓) No leak ตรวจการรั่วซึม		
Water Chiller: Camera (✓) check water level and refill ตรวจระดับน้ำและเติมน้ำ (✓) change water เปลี่ยนน้ำ Temperature -51 °C ตรวจอุณหภูมิ		
Exhaust Hood Flow rate 150 CFM (system request > 150)		

TELEDYNE LEE MAN LABS
P. 1111111111111111

AD

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODGY7

Customer: บริษัท อีทีแอล คอนสตรัคชั่น จำกัด
Date: Dec 12, 2022
Instrument: ICP-OES Model: Prodigy 7 S/N: P70177

2. Computer & Software Check

Description	Status
Interface Cable USB () No broken	ok
Software Version	ok
(x) Operation function check:	ok
(x) Open /Save /Edit method	ok
(x) Instrument Control	ok
(x) Sequence	ok
(x) Full Frame Capture (Echelle Mode)	ok
(x) Auto alignment /Hg alignment	ok
(x) Calibration Curve	ok
(x) Re-Calculation	ok
(x) Print Report	ok

OK

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODGY7

Customer: บริษัท อีทีแอล คอนสตรัคชั่น จำกัด
Date: Dec 12, 2022
Instrument: ICP-OES Model: Prodigy 7 S/N: P70177

3. Instrument Control

Description	Status
Optical view positig: ตรวจดูความสะอาดของเลนส์และกระจกในชุดตรวจ	
Hg Lamp Delta	
X 2 Y -9	ok
XUV 0	ok
Axial peak positions X 3325 Y 1215	ok
Radial peak positions X 4151 Y 1225	ok
Hg lamp peak positions X 2220 Y 2650	ok
Plasma Control ตรวจดูการทำงานของพลาสมา	
(x) Auto Start	ok
(x) Extinguish	ok
(x) RF power setting	ok
(x) Igniter	ok
(x) Air Knife	ok
Torch Gas ตรวจดูการทำงานของแก๊สที่ใช้ในพลาสมา	
(x) Coolant /Plasma Flow control	ok
(x) Aux Flow	ok
(x) Nebulizer Flow	ok
(x) Optimize sample introduction function	ok
(x) Peristaltic pump control	ok
(x) Auto sampler Control	ok
(x) Camera Support Module	ok
(x) Diagnostic	ok

COPY

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีเอ็น เทคโนโลยี จำกัด	Date: Dec 12, 2022
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

4. Cleaning & Replacement

Description	Status
(1) O-Ring Torch replacement	OK
(2) Pump Tubing replacement	OK
(3) Glassware cleaning (Torch, Nebulizer, Spray chamber)	OK
(4) Lube the roll peristaltic pump	OK
(5) Optical windows cleaning	OK
(6) Camera Water Re-circulator (water change/ refilled)	OK
(7) RF Generator Water Re-circulator (water change/ refilled)	OK
(8) Cleaning Electronics Board with spray cleaner	OK
(9) Cleaning dust inside Unit	OK
(10) Cleaning dust filter	OK

5. Safety Interlock

Description	Status
(1) Door switch	OK
(2) RF Water Re-circulator	OK
(3) Camera Water Re-circulator	OK
(4) Camera purge gas	OK
(5) Argon pressure	OK
(6) Nitrogen pressure	OK

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีเอ็น เทคโนโลยี จำกัด	Date: Dec 12, 2022
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

6. Hardware Check with SALSA.EXE Diagnostics



Power Supply	Value	Status
-12 VDC (11 - 14.5 VDC)	-13.75%	OK
+12 VDC (11 - 14.5 VDC)	+12.01%	OK
+3.3VDC	3.24%	OK
+5.0 VDC	4.44%	OK
+13.5 VDC	13.48%	OK
Plasma Generator	Value	Status
ICP Current 0.500A = 1kW	0.54%	OK
ICP Ref 5.0Vdc = 1kW	5.46%	OK
ICP Current 0.00 Vdc = 0kW	0	OK
ICP Ref 0.00Vdc = 0kW	0	OK
RF Water (Hz) OFF	0	OK
RF Water (Hz) ON	23	OK
Air Knife Pres. (0.00V) OFF	0	OK
Air Knife Pres. (3.0 - 7.0 V) ON	4.05%	OK
Neb 25 @ setting of 25 PSI	23	OK
Cool 18 @ setting of 18 LPM	1%	OK
Aux 0.6 @ setting of 6 LPM	0.6	OK
Camera Water Pump	Value	Status
Pump Current (0.000 A) OFF	0	OK
Pump Voltage (0.000 V) OFF	0	OK
Pump Current (0.8 to 4.0A) ON	1.04	OK
Pump Voltage (8 to 13 V) ON	12.52	OK
Set Points	Value	Status
Air In Set Point 32°C	31	OK
Cam. Temp. -32°C	-32	OK
Op Purge Low 0.77 LPM	0.7	OK
Op Purge High 15.50 LPM	15.5	OK
Cam Wtr T 28°C	28	OK

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODGY7

Customer: บริษัท สยามฟาร์ม จำกัด 1993 จำกัด	Date: Dec 12, 2022
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

7. Ma Check for performance Test

	Condition for performance Test	Condition Test	Status
Standard	1 ppm, 5 ppm, 10 ppm	10 100	ok
Power plasma	1.20 kw	1.2	ok
Plasma gas	16.0 LPM	16	ok
Auxiliary Gas	0.8 LPM	0.8	ok
Nebulizer	1.2 LPM	25 150	ok
Pump Speed	25 RPM	25	ok
Integration time	15 s Axial, 5 s Radial	10 s, 5 s	ok
Nebulizer Type	Seaspray, Conical, Mainhard	Seaspray	ok
Intensity first performance	1 ppm \geq 4,000,000 5 ppm \geq 15,000,000 10 ppm \geq 50,000,000	% 65,000,000	ok

Engineer Sign	12 Dec 2022
	
Sontchai Churnyaung	TELEDYNE LEE MAN LABS Everywhere you look

COPY

LIQUID IN GLASS THERMOMETER

Model : Total immersion

Serial No. : 43560



มูลนิธิพัฒนาอุตสาหกรรม
Foundation for Industrial Development
Food Industrial Laboratory Service Center

Calibration Certificate

Certificate No.: 2300368-001-01
Client name: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhaplarn 8 Rd.,
Nongkham, Sriracha, Chonburi 20230

Page 1 of 3

Equipment: Liquid-in-Glass Thermometer

Manufacturer: Precision

Model / Type: Total Immersion

Serial No.: 43560

ID No.: LABE 16/1

Order No.: 2300368

Operation No.: 2300368-001

Date of Receipt: 7 November 2022

Date of Calibration: 15 November 2022

Calibrated by Mr. Nutapol Niyomchat
Specialist

Date of Issue: 18 November 2022

Approved by (Mr. Phrasitit Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95 %.
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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



Calibration Report

Certificate No.: 2300368-001-01
Equipment: Liquid-in-Glass Thermometer
Type: Total Immersion
Range: -1.9 to 101.1 °C
Resolution: 0.1 °C
ID No.: LABE 16/1
Serial No.: 43560
Manufacturer: Precision
Date of Calibration: 15 November 2022

Page 2 of 3

Location: Temperature Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 23 °C ± 3 °C
Relative Humidity 55 % ± 15 %

Condition of this results of Calibration:

1. Calibration Method : - In-house method : W-TE-015 based on ASTM E77-07
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature Scale in use at this laboratory is the International Temperature Scale of 1990 (ITS-90).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
BLACK STACK THERMOMETER Platinum Resistance Thermometer (PRT)	1560/2560	A39258/A39719	PSL-T 0674/65	7-Jun-23	TISTR

Support Equipment : - Ice point Unit, ID No.: 614/21

- Low Temperature Bath (Deep Well Compact Bath), Model: 7381, S/N: B53496.
- Low Temperature Bath (Deep Well Compact Bath), Model: 7341, S/N: A54084.
- High Temperature Bath (Deep Well Compact Bath), Model: 6331, S/N: A54087.

3 This certificate is traceable to International System of Units (SI Units).

4. This certificate was certified only for the instrument we calibrated.

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

6. Condition of Calibrated item : Good

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

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



Calibration Report

Certificate No.: 2300368-001-01
Equipment: Liquid-in-Glass Thermometer Type: Total Immersion
Range: -1.9 to 101.1 °C Resolution: 0.1 °C
ID No.: LABE 16/1 Serial No.: 43560
Manufacturer: Precision
Date of Calibration: 15 November 2022 Page 3 of 3

Calibration point: 3.0, 25.0 and 50.0 °C
Calibration result:

Reporting of ice-point or reference point

UUC ^a Reading (°C)	Standard Temperature/Ice Point (°C)	Correction Value (°C)	Uncertainty ± (°C)
0.0	0.0032	0.0	0.091

Reporting of temperature calibration point

UUC ^a Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
25.0	24.9990	0.0	0.088
50.0	49.9943	0.0	0.088

Note

^a UUC^a : Unit Under Calibration

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

----- End -----



Signature

MERCURY ANALYZER

Model : RA-4500

Serial No. : 21780504



บริษัท โคแอก กรุ๊ป คอร์ปอเรชั่น จำกัด
COAX GROUP CORPORATION LTD.

COAX GROUP CORPORATION LTD.

DATE : March 24, 2023

Certificate of Calibration

MERCURY ANALYZER FOR WORKING ENVIRONMENT
THERMOMETER / RA-4500

Customer name : Eastern Thai Consulting 1992 Co.,Ltd.

Certificate No : SRP001-23
Customer P/O : PO.no.PL6602053
Sale Order No : -

Model # RA-4500
Serial No. # 21780504

Results : Quality Reborn Reference Standard Laboratory, NSC-TISI-TIS 17025 Calibration No.0292

Cal. Points	TIME	PRESET TEMP	Avr.	FACTOR ±0.5
3 Point	60 Minutes	95 (°C)	90.73	0.950 - 1.050

This instrument is calibrated at factor 0.955

TEST APPARATUS	
Instrument Type	Serial Number
PONPE 429TP	5845166
PONPE 429TP	5845167
PONPE 429TP	5845168



Date of Calibrate : March 24, 2023
Next due date : March 24, 2024

Calibrate by :  (Siriraj Punsri)
Service Engineer
Environments & Petroleum Division

Approve by :  (Pathom Savises)
Service Manager
Environments & Petroleum Division

COPY

Eastern Thai Consulting 1992 Co., Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 21780504

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : February 09, 2023

Next due date : August 09, 2023

PM by :  (P. Siriraj)

Approved by :  (Pathom S.)



Coax Group Corporation Ltd.

1131/62,54,325-331 Nakornchaisri road,
Kwang Thanon Nakornchaisri, Dusit, Bangkok 10300 Thailand
Tel. 02-2435263, 02-6682436 Fax. 02-2437386

COPY

Inspection result

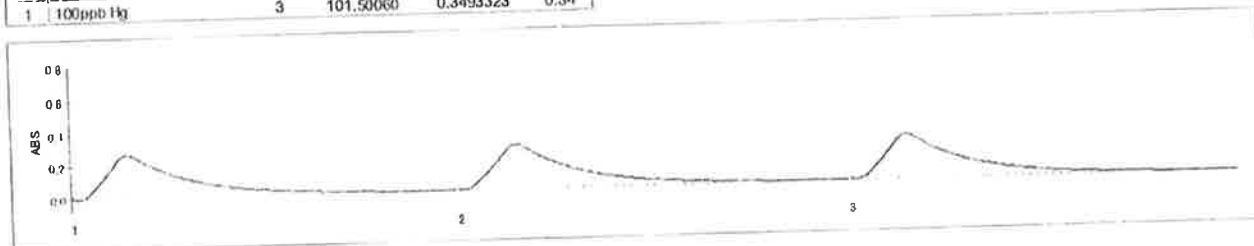
ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Leak check	0.14 - 2.0L/min	0.17L/min	PASS
1.2 Sig/Ref check	Signal 3.00 - 4.00V Sig:3.97V, Ref:3.89V		PASS
1.3 Drift check	0.0000236 - 0.0000061	0.0000175	PASS
2. Analytical curve inspection(AREA)			
2.1 Calibration curve 0-100ng (Height)	Correlation coefficient	1.0000	PASS
(r) ≥ 0.9999			
3. Repeatability(AREA)			
3.1 Repeat STD 50ng, n=3			
	1.	50.60 ng	
	2.	50.94 ng	
	3.	50.71 ng	
	C.V. ≤ 5%	0.34%	PASS
4. Blank	Below 1.0(AREA)	0.0158	PASS

CDR

S10		SVOL	CVOL	DVOL	AREA	MEAS	CONC	Color		Note
No.	NAME	[mL]	[mL]	[mL]	[ON]	[ng]	[ug/L]	[1]	[2]	
1	100ppb Hg	0.500	5.000	5.000	73.5373	50.6006	101.2012	-	-	
2	100ppb Hg	0.500	5.000	5.000	74.0347	50.9422	101.8844	-	-	
3	100ppb Hg	0.500	5.000	5.000	73.6938	50.7081	101.4162	-	-	

Statistics

No.	NAME	TRY	AV	SD	Cv
			[ug/L]	[ug/L]	[%]
1	100ppb Hg	3	101.50060	0.3493323	0.34



Self Check

Heat check: PASS!! (27.1degC[05:00] -> 31.2degC[03:03])
 Sensor check: PASS!! (3488-133-3355)
 Leak check: PASS!! (0.17L/min)
 Sig/Ref check: PASS!! (Sig: 3.97V, Ref: 3.89V)
 Drift check: PASS!! (0.0000236 - 0.0000061 = 0.0000175)

COPY

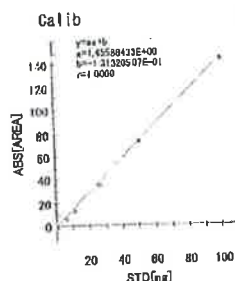
NIPON INSTRUMENTS CORPORATION

9/2/2566 16:11

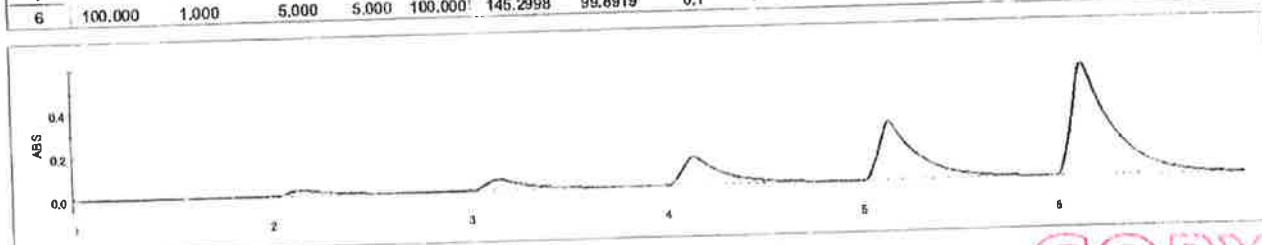
Title RA-4500 Preventive Maintenance no.2of2 in Warranty
 Date 9/2/2566
 Name Coax Group Corporation Ltd.
 Memo Calibration curve, range 0-100ng

Method

Method1 (Pretreatment: without)
 (1+1) H2SO4 : 0.9mL
 10w/v% SnCl2 : 0.5mL
 Measurement Time (sec) : 120sec



S10		STD	SVOL	CVOL	DVOL	STD	AREA	MEAS	Dev	Color		Note
No.		[ppb]	[mL]	[mL]	[mL]	[ng]	[ON]	[ng]	[%]	[1]	[2]	
1		100.000	0.000	5.000	5.000	0.000	0.0158	0.1011	-	-	-	
2		100.000	0.050	5.000	5.000	5.000	7.4089	5.1791	3.8	-	-	
3		100.000	0.100	5.000	5.000	10.000	14.1152	9.7855	2.1	-	-	
4		100.000	0.250	5.000	5.000	25.000	35.6872	24.6028	1.6	-	-	
5		100.000	0.500	5.000	5.000	60.000	73.3032	50.4398	0.9	-	-	
6		100.000	1.000	5.000	5.000	100.000	145.2998	99.8919	0.1	-	-	



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NIPON INSTRUMENTS CORPORATION

pH Meter

Model. : SevenCompact S220

Serial No. : B448305208



CERTIFICATE OF CALIBRATION

Certificate No. : 23-011524
Sample Code : 23-04833-001

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sirachua, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : pH Meter
Manufacturer : METTLER TOLEDO
Model : SevenCompact S220
Serial No. : B448305208
ID No. : LABE 11/4
Date of Receipt : 01 February 2023
Date of Calibration : 01 February 2023

Condition of Calibration

1. Environment
1.1 Ambient temperature : 25.0 ± 2.5 °C
1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method
In house method WI-CL-019, based on direct measurement by using standard voltage calibrator and using certified reference material (CRM).

Instrument	ID No.	Certificate No.	Due Date
3.1 Voltage Calibrator	LB-AMC-01	22E3240	03 October 2023
3.2 Digital Thermometer	LB-TH-33	22-107027	02 October 2023
Certified Reference Material			
Lot No.	Ref No.	Expiry Date	
3.3 Buffer Solution pH 4.008	838357	15 September 2024	
3.4 Buffer Solution pH 6.985	838358	15 September 2023	
3.5 Buffer Solution pH 10.008	838359	15 September 2023	

4. This certificate is traceable to the international system of unit (SI Unit).

- 4.1 Instrument No. 3.1 through Technology Promotion Association (Thailand-Japan).
4.2 Instrument No. 3.2 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.
4.3 Buffer Solution No. 3.3 and No. 3.5 traceable to CPA chem (through primary measurement method-Harned cell using calibrated thermometer, barometer, and nanovoltmeter Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).
4.4 Buffer Solution No. 3.4 traceable to CPA chem (BIM RefN HI-27 LoN 04.06.2021, BIM RefN HI-28 LoN 28.05.2021; BIM RefN HI-27 LoN 04.06.2021; BIM RefN HI-28 LoN 28.05.2021 Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034)

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

6. Condition of calibration item : Normal

Calibrated by : Mr. Anupong Lakawin
Scientist

Approved by : (Ms. Pawana Pan-on)
Signed for Director

Issue date : 03 February 2023

The uncertainties are for a confidence probability of approximately 95%.
The calibration is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement, realized in the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).



Page 2 of 3
Certificate No. : 23-011524
Sample Code : 23-04833-001

REPORT OF CALIBRATION

Equipment : pH Meter
Manufacturer : METTLER TOLEDO
Model : SevenCompact S220
Serial No. : B448305208
ID No. : LABE 11/4
Range : -2.000 pH to 20.000 pH ; ± 2000.0 mV ; -5.0°C to 130.0°C

Resolution : 0.01 pH ; 0.1 mV ; 0.1°C

Results of Calibration

Part 1. DC Voltage measurement
pH Meter Serial No. : B448305208

Nominal Value	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	414.0	0.00	± 0.063	2.00
4	177.477	177.5	4.00	± 0.063	2.00
7	0.000	0.1	7.00	± 0.063	2.00
10	-177.477	-178.3	10.00	± 0.063	2.00
14	-414.113	-413.8	14.00	± 0.063	2.00

Part 2. Performance of Electrode system

Electrode Manufacturer : METTLER TOLEDO
Electrode Serial No. : 2365921
Model : InLab Expert Pro-ISM

Three-Point Calibration at pH4 and pH7 Percent Slope : 99.6%, at pH7 and pH10 Percent Slope : 98.4

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.01	184.2	0.002	± 0.011	2.00
6.985	6.99	8.9	0.005	± 0.010	2.00
10.008	10.01	-166.8	0.002	± 0.010	2.00

The result extended uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor k which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.





REPORT OF CALIBRATION

NSG-TSI-TSI17025
CALIBRATION0152

Page 3 of 3

Certificate No. : 23-011524

Sample Code : 23-04833-001

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO

Serial No. : B448305208

Resolution : 0.1 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO

Serial No. : 2365921

Model : InLab Expert Pro-ISM

ID No. : N/A

Condition of Calibration

1. Environment

1.1 Ambient temperature : 23.0 °C ± 3.0 °C

1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method

2.1 The calibration use in house method W1-CL-021 : by comparison with standard thermometer

2.2 The calibration by comparison unit under calibration (UUC) to the standard thermometer in a calibration bath at the controlled temperature

2.3 The temperature scale in use of this laboratory is the international temperature scale of 1990 (ITS-90).

3. Reference standard instrument

Instrument	Model	ID. No.	Certificate No.	Due date
3.1 Platinum Resistance Thermometer	PT-100	RTD-90	22-107027	02 October 2023
3.2 Thermometer Readout	G1-11	LB-TH-33	22-107027	02 October 2023

4. This certificate is traceable to the international system of unit (SI Unit).

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Accreditation Under TLAS Laboratory Calibration No.0152)

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

6. Condition of Calibration item : Normal

Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration		Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C		
25	25.002	120	25.0	± 0.13	2.00

Notes

Calibration results without adjustment

The result expanded uncertainty of measurement (U₉₅) stated as the expanded uncertainty of measurement (multiplied by the coverage factor k, which for a normal distribution corresponds in a coverage probability of approximately 95%). The standard uncertainty of measurement has been determined in accordance with ISO/IEC 17003.

End of report

DD

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PH-CL 018

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Rev.00

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File Ref: Date 15/10/21

STANDARD WEIGHT 50 g



Page 1 of 3

Certificate No. : 22-052238
Sample Code : 22-19150-003

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukthepiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist
Issue date : 31 May 2022

Approved by

(Mr. Somchai Neampunt)
Signed for Director

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

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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WWW.AMARC.CO.TH
Effective Date: 15/10/21



Page 2 of 3

Certificate No. : 22-052238
Sample Code : 22-19150-003

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g
Manufacturer : METTLER TOLEDO
Class : F1
Serial No. : N/A
ID No. : LABE 10/1

Result of Calibration : ☒ Without adjustment ☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_0) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	\pm (mg)	
50 g	-0.324	49.999676 g	0.10	0.30	LABE 10/1

The result expanded uncertainty of measurement U is stated in the standard uncertainty of measurement multiplied by the coverage factor $k=2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

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WWW.AMARC.CO.TH
Effective Date: 15/10/21



Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.20 kg/m³
2. Calibration Method : Direct comparison weighing according to OIML R111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

End of Report

COPY

STANDARD WEIGHT 100 g

NSC-TIS-71577025
CALIBRATION 0052

Page 1 of 3

Certificate No. : 22-052239
Sample Code : 22-19150-004

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230
Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist
Issue date : 31 May 2022

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

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation schemes which has assessed the measurement capability of the laboratory and its traceability to recognised national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced either in full or in part without the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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Effective Date: 15/01/21NSC-TIS-71577025
CALIBRATION 0052

Page 2 of 3

Certificate No. : 22-052239
Sample Code : 22-19150-004

REPORT OF CALIBRATION

Equipment : Standard Weight 100 g
Manufacturer : N/A
Class : N/A
Serial No. : N/A
ID No. : LABE 10/2Result of Calibration : ☒ Without adjustment ☐ AdjustmentConventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_a) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	\pm (mg)	
100 g	-0.171	99.99829 g	0.16	0.50	LABE 10/2

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

COPY

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WWW.AMARC.CO.TH
Effective Date: 15/01/21



Certificate No. : 22-052239

Sample Code : 22-19150-004

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m³
2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WF-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated item :

Type and Nominal Value :	Standard Weight 100 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

COPY

STANDARD WEIGHT 50 g



Certificate No. : 22-052237

Sample Code : 22-19150-002

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhaphiban 8 Rd., Nongkham,

Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 2022

Approved by

(Mr. Somchai Neampunt)

Signed for Director

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

The calibration result is applied only to the above calibrated item and was found accurate as shown on data and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its inability to recognize national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).



Certificate No. : 22-052237

Sample Code : 22-19150-002

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Result of Calibration :

Without adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_0) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	± (mg)	
50 g	-0.111	49.999889 g	0.10	0.30	LABE 10/4

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

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Certificate No. : 22-052237

Sample Code : 22-19150-002

REPORT OF CALIBRATION

Condition of Calibration:

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m³

2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079386	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

. End of Report .

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SPECTROPHOTOMETER

Model : PROVE 100

Serial No. : 1613110857



CERTIFICATE OF CALIBRATION

Instrument : SPECTROPHOTOMETER
Model : PROVE 100
Date of Calibration : February 13, 2023
Customer Name : Eastern Thai Consulting 1992 Co., Ltd.

Procedure used

The wavelength accuracy and the linearity of the absorbance measurement of photometers are checked using Check solutions according to Merck calibration laboratory work instruction.

Measurements results

Function : Absorbance measurement.
All data shown below as received values of blank solution before adjustment.

Check Solution (Abs.)	Wavelength (nm)	Desired Absorbance (Abs.)	Measured Absorbance (Abs.)	Error (Abs)
0.000	445	0.000 ± 0.005	0.000	0.000
0.000	525	0.000 ± 0.005	0.000	0.000
0.000	690	0.000 ± 0.005	0.000	0.000

CERTIFICATE No. **WO-02514383**



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CERTIFICATE OF CALIBRATION

Function : Absorbance measurement.
All data shown below were final value of standard solution after adjustment.

Check Solution* (Abs.)	Desired Absorbance (Abs.)	Allowed tolerance (Abs.)	Actual Absorbance (Abs.)	Assessment Yes/No
445-1	0.198	± 0.020	0.196	Yes
445-2	0.496	± 0.030	0.493	Yes
445-3	0.994	± 0.040	0.985	Yes
445-4	1.492	± 0.050	1.475	Yes
525-1	0.197	± 0.020	0.195	Yes
525-2	0.494	± 0.030	0.491	Yes
525-3	0.986	± 0.040	0.984	Yes
525-4	1.482	± 0.050	1.480	Yes
690-1	0.197	± 0.020	0.197	Yes
690-2	0.498	± 0.030	0.497	Yes
690-3	0.985	± 0.040	0.978	Yes
690-4	1.485	± 0.050	1.482	Yes

* Spectroquant Photocheck (Check Solution) Lot : HC35941

- Check solution for this certification is traceable to : Reference Photometer Agilent Cary 4000 checked and calibrated using NIST-grey glass filter SGM 1920 and Holmiumoxide Solution NIST SRM 2034
- Desired absorbance round cell has been calculated from the absorbance of the 1 cm cell using the path length of the round cell and is entered as the desired



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CERTIFICATE OF CALIBRATION

Software version: 1.5.1

Wavelength Accuracy			
Equipment	Nominal value	Tolerance limit	Result
Holmium Oxide Liquid Filter Helina 657-UV5	361.25 nm	380.1 - 382.5 nm	P
	536.55 nm	538.4 - 539.3 nm	P
	640.55 nm	638.4 - 642.8 nm	P
Photometric Accuracy			
Equipment	Wavelength	Nominal value	Result
Neutral Density 1.00 Abs. Helina 656-F4	440 nm	1.079 A	P
	546 nm	1.012 A	P
	635 nm	1.050 A	P
Stray Light			
Equipment	Wavelength	Nominal value	Result
UV-VIS Standard 2 Sodium Nitrite Solution	340 nm	≤0.10 %T	P
Self-test Hardware			
No visual flaws, no burrs, no loose parts and fastenings			



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CERTIFICATE OF CALIBRATION

INSTRUMENT : SPECTROPHOTOMETER
MANUFACTURER : Merck KGaA, Darmstadt, Germany
MODEL : PROVE 100
SERIAL No. : 1613110857
CLIENT : Eastern Thai Consulting 1992 Co., Ltd.
DATE OF ISSUE : February 13, 2023

APPROVED SIGNATORY

NAME : Mr. Rawat Rattanachetthakul
(SERVICE ENGINEER)

SIGNATURE :

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CERTIFICATE No. WO-02514383

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



CERTIFICATE OF CALIBRATION

Certificate No. : 22-068062
Sample Code : 22-24531-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration laboratory)

Equipment : Digital thermo-hygrometer
Manufacturer : testo
Model : 606-H1
Serial No. : 45106737
ID No. : LABE 09/7
Date of Receipt : 22 June 2022
Date of Calibration : 24 June 2022

Condition of Calibration

1. Environment : 1.1 Ambient temperature : 23.0 °C ± 3.0 °C
1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method

2.1 In-house method: WH-CL-Q45 By comparison with thermometer standard / chilled mirror hygrometer in controlled chamber.
2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer in a chamber at the controlled temperature / relative humidity.

3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew Vision	LB-DP-01 & LB-DP-01 (DP)	TH-0014-22	18 February 2023
3.2 Digital Thermometer	Optidew Vision	LB-DP-01 & LB-DP-01 (Temp.)	22-029549	14 March 2023
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	21-072473	13 September 2022

4. This certificate is traceable to the international system of unit (SI Unit).

4.1 Instrument No. 3.1 through National Institute of Metrology (Thailand).
4.2 Instrument No. 3.2 and 3.3 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by

Miss Pornsuda Lohabel

Approved by

(Mr. Somchai Niamput)

Issue date

27 June 2022

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

This certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Institute which has selected the measurement capability of the laboratory and is traceable to recognized national standards and is the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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EFFECTIVE DATE 15/07/21

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REPORT OF CALIBRATION

Certificate No. : 22-068062
Sample Code : 22-24531-002

Results of Calibration

Temperature measurement

Resolution : 0.1 °C
Range : 0 °C to 50 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.00	20.2	- 0.20	± 0.39
25	50	25.00	24.9	+ 0.10	± 0.39
30	50	30.00	29.8	+ 0.20	± 0.39

Humidity measurement

Resolution : 0.1 %RH
Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.13	51.4	+ 6.27	± 1.3
60	25.00	60.03	68.5	+ 8.47	± 1.5
75	25.00	75.20	81.5	+ 6.30	± 1.7

Notes

Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with GUM 1992.

- End of Report -



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UV/VIS SPECTROPHOTOMETER

Model : UV - 1800

Serial No. : A11635101643 CD



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Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com

Bara Scientific

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Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-152/23
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11835101643 CD
ID No. N/A
Date of receipt 25 April 2023
Date of calibration 25 April 2023
Date of issue 27 April 2023

Customer name Eastern Thai Consulting 1992 Co., Ltd.

Address 683 Moo 11, Sukkaphibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature (22.4-23.1) °C (On site)
Humidity (44.5-45.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Analysis Department

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01
Traceability Wavelength Accuracy is traceable to certificate No. 94780 and 94775
Photometric Accuracy is traceable to certificate No. 94808 and 100147
Sirey Light is traceable to certificate No. 94791
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Pannaphong Phannmekakul

Approved by
Mr. Kanchit Choothep
Technical Manager

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Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-152/23

Calibration Results:

1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.65	-0.06	0.18
445.82	445.80	-0.02	0.18
536.52	536.35	-0.17	0.18
741.02	740.99	-0.03	0.18
879.41	879.27	-0.14	0.18

2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
257	0.7311	0.7313	0.0002	0.0075
313	CNR	CNR	CNR	CNR
350	CNR	CNR	CNR	CNR

*CNR = Customer not request



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Certificate of Calibration

Certificate No. **BSCC-UV-152/23** Number of Page(s) **3 of 3**

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5488	0.5508	0.0020	0.0042
	0.7527	0.7535	0.0008	0.0042
	1.0756	1.0758	0.0002	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5391	0.5406	0.0015	0.0042
	0.7355	0.7360	0.0005	0.0042
	1.0508	1.0501	-0.0008	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5045	0.5044	-0.0001	0.0042
	0.6884	0.6885	0.0001	0.0042
	0.9516	0.9509	-0.0008	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5183	0.5178	-0.0005	0.0042
	0.6864	0.6868	0.0004	0.0042
	0.9747	0.9739	-0.0008	0.0042

*CNR = Customer not request

4. Stray Light*

Standard	Wavelength (nm)	Unit Under Calibration(UUC)
cut-off wavelength (nm)	200.72	Transmission (%T)
200.7±0.11nm	200.72	Absorbance (A)
		2.0184

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A
*Stray Light not NSC-QNSC Accredited.

The measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%
End of Certificate

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