ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ภาคผนวกที่ 5.1 เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำทิ้ง

ภาคผนวกที่ 5.1

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำทิ้ง

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CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com

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THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0039
CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	pH METER
MANUFACTURER	:	HANNA
MODEL / TYPE	:	HI2211/HI1131/N/A
SERIAL NO.	:	H0064643/0347487N/TH118405[SV-TL.080/2560]
CLID. NO.	:	272101552
JOB CONTROL NO.	:	220709070124

CUSTOMER : ENVIRPRO CO., LTD.
168/28 NAKNIWAS RD., LADPRAO,
BANGKOK 10230 THAILAND

DATE OF RECEIVED : 09 July 2022 DATE OF ISSUED : 15 July 2022

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Seehanart
Monthira Treechum
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
15 July 2022

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q22070124

F3-011-04/01-12

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NSC-TISI-TIS 17025
CALIBRATION 0059
CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	**pH METER**
MANUFACTURER	:	**HANNA**
MODEL / TYPE	:	**HI2211/HI1131/N/A**
SERIAL NO.	:	**H0064643/0347487N/THI18405[SV-TL.080/2560]**
DATE OF CALIBRATION	:	**11 July 2022**

ENVIRONMENT CONDITIONS :

Temperature : (25 ± 2.5) °C **Relative Humidity :** (50 ± 15) % RH

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-128** [pH Meter]. The calibration was performed by direct measurement with Certified Reference Material (CRM).

This instrument was calibrated under procedure No. **WI-305-187** [pH Temperature] based on **ASTM E 644-04** as calibration guidelines. The calibration was performed by using Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06-664-260,11754256, Lot Number CC728484.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F201 S/N. 016168/09.
5. IPRT, ASL Model T100-250-1D S/N. L0193A-1-1.

@clccalibration

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).

Lot Number. 160221 , 180121. Due Date 05 May 2023.

2. The measurements are traceable to International System of Units (SI) , through Control Company.

Certificate No. 4281-12405788 , Due Date 30 June 2023.

3. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q22007520, Due Date 22 January 2023.

4. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific

and Technological Research (TISTR). Certificate No. PSL-T 1094/64, Due Date 04 November 2022.

5. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).

Certificate No. TT-0121-21, Due Date 24 November 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2021)"

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of Measurement (± pH)	k Factor
4.000	3.99	159.6	+0.010	0.014	2,00
6.996	7.01	-12.6	-0.014	0.014	2,00
10.007	10.00	-171.0	+0.007	0.100	2,00

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 79 of 111

2. TEMPERATURE RESULT [THERMISTOR]

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
104	25.00	25.0	0.00	0.07

Note. Probe ∅ 3 mm

Materials : Stainless Steel.

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of k = 2,00.

The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 28 of 111

This report is valid for the above stated instrument/s only.

End of Certificate

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CERTIFICATE OF CALIBRATION

Certificate No.: B1-0607011/22

Customer ENVIRPRO CO., LTD.
168/28 Nakniwas Rd., Ladprao, Bangkok 10230

Equipment	Electronic Balance		
Manufacturer	Sartorius	**Model**	BP221S
Serial No.	12308434	**ID No.**	SV-TL.001/2545
Description	Maximum Capacity: 220 g	Resolution:	0.0001 g

Environmental Conditions	Ambient Temperature:	24 °C
	Relative Humidity:	51 %
	Atmospheric Pressure:	-
Calibration Location	ห้องเครื่องชั่ง	
Received Date	6 July 2022	
Calibration Date	6 July 2022	
Date of Issue	7 July 2022	
Condition of the artifacts	Good Conditions	

Checked by _____ **Approved by** _____

Act as Technical Manager

Representative of Managing Director

(Dr. Ekachai Puttitwong)

( ) (Krisyosl K.) ( ) (Sakda Y.)
( ) (Patiphan K.) ( ) (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
(✓) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

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Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507

Reference Method:

- The calibration method used was CP-208 based on UKAS LAB 14
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Standard Weight Set 1 g - 200 g	-	B916537870	MM-0018-21	Mar. 9, 2023	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

☑ Without Adjustment

☐ After Adjustment

1. Repeatability

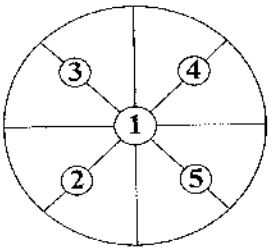
Nominal Weight	Standard Deviation of Reading (g)
200 g	0.00006

Authorized by Amorn

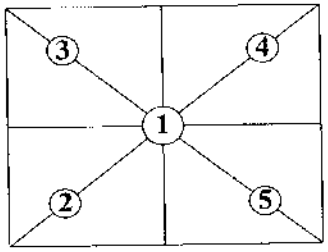
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Measurement Results (Cont.):

2. Off-Center Loading



Front ☑



Front ☐

Measuring Positions

Measuring Positions	Instrument Reading (g)	Max. Difference (g)
1	49.9999	0.0002
2	49.9999	
3	50.0001	
4	50.0000	
5	50.0000	
1	50.0000	

3.Error of indication from nominal value

Standard Weight (g)	Instrument Reading (g)		Correction (g)	Uncertainty of Measurement (g)
	Without Adjustment	After Adjustment		
1.0000	1.0000	-	0.0000	± 0.00011
2.0000	2.0000	-	0.0000	± 0.00011
5.0000	5.0000	-	0.0000	± 0.00011
10.0000	10.0000	-	0.0000	± 0.00011
20.0000	20.0000	-	0.0000	± 0.00012
50.0000	49.9999	-	0.0001	± 0.00013
100.0000	100.0000	-	0.0000	± 0.00016
120.0001	119.9999	-	0.0002	± 0.00028
150.0001	149.9999	-	0.0002	± 0.00028
200.0001	[illegible]	[illegible]	0.0002	± 0.00030

Amorn

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Measurement Results (Cont.):

4. Effect of Tare

Nominal Tare Weight (g)	Standard Weight (g)		Instrument Reading (g)	Instrument Deviation (g)
50	Tare		0.0000	0.0000
	at 20 %	10.0000	9.9999	-0.0001
	at 40 %	20.0000	19.9999	-0.0001
	at 60 %	50.0000	50.0000	0.0000
	at 80 %	100.0000	100.0000	0.0000
	at 100 %	150.0000	149.9999	-0.0001

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

Calibrated by: Amorn

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CERTIFICATE OF CALIBRATION

Certificate No.: T1-0607017/22 **Page** 1 **of total** 3 **pages**

Customer ENVIRPRO CO., LTD.
168/28 Nakniwas Rd., Ladprao, Bangkok 10230

Equipment	Incubator		
Manufacturer	ACCUPLUS	**Model**	i250DS
Serial No.	I250402-0510-0315	**ID No.**	SV-TL.030/2553
Description	Resolution of UUC : 0.1 °C		

Environmental Conditions	Ambient Temperature:	23.8 °C
	Relative Humidity:	55 %
	Atmospheric Pressure:	-
Calibration Location	Analysis Laboratory 2	
Received Date	6 July 2022	
Calibration Date	6 July 2022	

Date of Issue 7 July 2022

Checked by _____ **Approved by** _____

Act as Technical Manager

Representative of Managing Director

(Dr. Ekachai Puttitwong)

( ) (Krisyosl K.) ( ) (Sakda Y.)
( ) (Patiphan K.) ( ) (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

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Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507

Reference Method:

- The calibration method used was CP-084 based on TLAS G-20-1/02-08 (E).
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY57010717/ MY59004982	I0-1308001/22	Aug. 12, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results: (X) Without Adjustment

Reporting of Temperature Distribution

UUC Reading (°C)	Measured Temperature (°C) @ sensor No. (Sensor No. 9 is Ref.)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9	
4.0	4.63	4.54	4.47	4.69	4.69	4.58	4.43	4.25	4.74	0.20

Reporting of Chamber Performance

Setting Temperature (°C)	UUC Reading (°C)	Uniformity (°C)	Stability (°C)	Overall Variation (°C)
4.0	4.0	0.59	0.38	1.06

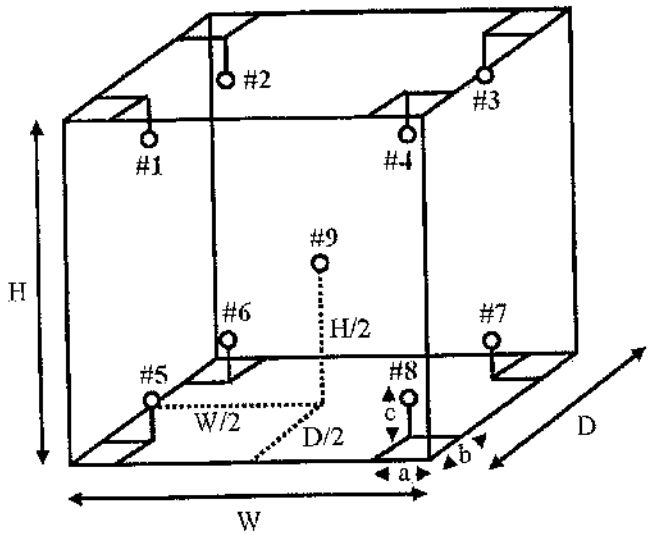
UUC: Unit Under Calibration

Apisit

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Measurement Results (Cont.):

Sensor Installation



Working space :

W x H x D	50	cm.x	104	cm.x	46 cm.
a x b x c	5	cm.x	5	cm.x	5 cm.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

Apisit

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CERTIFICATE OF CALIBRATION

Certificate No.: T1-0607016/22 **Page** 1 **of total** 3 **pages**

Customer ENVIRPRO CO., LTD.
168/28 Nakniwas Rd., Ladprao, Bangkok 10230

Equipment	Hot Air Oven		
Manufacturer	MEMMERT	**Model**	UFE400
Serial No.	G410.0133	**ID No.**	SV-TL.021/2553
Description	Resolution of UUC : 0.1 °C		

Environmental Conditions	Ambient Temperature:	25.9 °C
	Relative Humidity:	47 %
	Atmospheric Pressure:	-
Calibration Location	Analysis Laboratory 1	
Received Date	6 July 2022	
Calibration Date	6 July 2022	

Date of Issue 7 July 2022

Checked by _____ **Approved by** _____

Act as Technical Manager

Representative of Managing Director

( ) (Krisyosl K.) ( ) (Sakda Y.)
( ) (Patiphan K.) ( ) (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

(Dr. Ekachai Puttitwong)

This calibration [illegible] except with the prior written approval of the Thai [illegible]

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Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507

Reference Method:

- The calibration method used was CP-084 based on TLAS G-20-1/02-08 (E).
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY59002152/ MY41166060	I0-0401002/22	Jan. 5, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- THC, Thai Heart Calibration Co., Ltd.

Measurement Results: (X) Without Adjustment

Reporting of Temperature Distribution

UUC Reading (°C)	Measured Temperature (°C) @ sensor No. (Sensor No. 9 is Ref.)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9	
104.0	104.65	104.41	104.40	103.93	104.28	104.21	104.13	103.90	104.03	0.20
180.0	180.77	180.62	180.51	179.28	180.20	180.23	180.13	179.75	180.02	0.20

Reporting of Chamber Performance

Setting Temperature (°C)	UUC Reading (°C)	Uniformity (°C)	Stability (°C)	Overall Variation (°C)
104.0	104.0	0.74	0.17	1.03
180.0	180.0	0.92	0.28	1.77

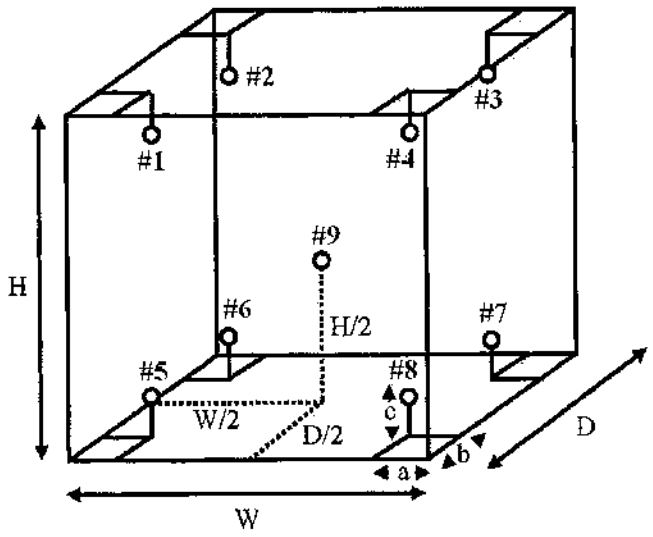
UUC: Unit Under Calibration

Apisit

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Measurement Results (Cont.):

Sensor Installation



Working space :

W x H x D	40	cm.x	40	cm.x	33 cm.
a x b x c	5	cm.x	5	cm.x	5 cm.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

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CERTIFICATE OF CALIBRATION

Certificate No.: C1-0607001/22 **Page** 1 **of total** 3 **pages**

Customer ENVIRPRO CO., LTD.
168/28 Nakniwas Rd., Ladprao, Bangkok 10230

Equipment	Spectrophotometer		
Manufacturer	HACH	**Model**	DR 6000
Serial No.	1893325	**ID No.**	SV-TL.110/2562
Description	-		

Environmental Conditions	Ambient Temperature:	27.1 °C
	Relative Humidity:	59 %
	Atmospheric Pressure:	-
Calibration Location	Analysis Laboratory 1	
Received Date	6 July 2022	
Calibration Date	6 July 2022	

Date of Issue 7 July 2022

Checked by

Act as Technical Manager

( ) (Krisyosl K.) ( ) (Sakda Y.)
( ) (Patiphan K.) (✓) (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

Approved by

Representative of Managing Director

(Dr. Ekachai Puttitwong)

This calibration [illegible] with the prior written approval of the Thai Heart Calibration Co., Ltd.

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Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507

Reference Method:

- The calibration method used was CP-004 based on an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Holmium Glass Filter	RM-HG	34645	100503	Mar. 25, 2024	Starna
Didymium Glass Filter	RM-DG	11978	100499	Mar. 25, 2024	
Neutral Density Filter	RM-1N2N3N	11562	100582	Mar. 30, 2024	
60 mg/l Potassium Dichromate	RM-06	31473	100505	Mar. 25, 2024	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- Starna Scientific Ltd.

Measurement Results:

Spectral Bandwidth : 2 nm, Scan Speed : 0.1

1. Wavelength accuracy

Standard Wavelength (nm)	UUC Reading (nm)	Correction (nm)	Uncertainty (± nm)
361.00	360.2	0.80	0.13
418.61	418.4	0.21	0.13
536.66	536.0	0.66	0.13
684.49	684.3	0.19	0.14
748.48	748.4	0.08	0.14

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Measurement Results (Cont.):

2. Photometric Accuracy

UV Region

Wavelength (nm)	Standard Value (A)	UUC Reading (A)	Correction (A)	Uncertainty (± A)
235	0.7444	0.743	0.0014	0.0051
257	0.8622	0.859	0.0032	0.0051
313	0.2899	0.292	-0.0021	0.0051
350	0.6384	0.636	0.0024	0.0051

Visible Region

Wavelength (nm)	Standard Value (A)	UUC Reading (A)	Correction (A)	Uncertainty (± A)
440	1.0353	1.034	0.0013	0.0029
	0.7311	0.730	0.0011	0.0029
	0.5432	0.543	0.0002	0.0029
465	0.9650	0.964	0.0010	0.0029
	0.6749	0.674	0.0009	0.0029
	0.4937	0.494	-0.0003	0.0029
546.1	0.9959	0.994	0.0019	0.0029
	0.6850	0.683	0.0020	0.0029
	0.5082	0.508	0.0002	0.0029
590	1.0356	1.033	0.0026	0.0029
	0.7147	0.713	0.0017	0.0029
	0.5369	0.536	0.0009	0.0029
635	0.9878	0.986	0.0018	0.0029
	0.6826	0.682	0.0006	0.0029
	0.5216	0.522	-0.0004	0.0029

UUC : Unit Under Calibration.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

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NSC - TISI - TIS 17025
CALIBRATION 0059
CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	**LIQUID IN GLASS THERMOMETER**
MANUFACTURER	:	**N/A**
MODEL / TYPE	:	**0-100 °C**
SERIAL NO.	:	**N/A[SV-TL.020/2551]**
CLID. NO.	:	**232102154**
JOB CONTROL NO.	:	**220709070044**

CUSTOMER : **ENVIRPRO CO., LTD.**
168/28 NAKNIWAS RD., LADPRAO,
BANGKOK 10230 THAILAND

DATE OF RECEIVED : 09 July 2022 **DATE OF ISSUED : 12 July 2022**

Report of calibration screening must not be taken in part, Except complete, Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Monthira Treechum
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
12 July 2022

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

@clccalibration

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 1 Prasert Manukit Rd., Ladprao Bangkok 10230
Tel 02-578-0353-4 Fax: 02-576-2672 www.calaboratory.com E-mail:sale@calaboratory.com

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NSC-TISI-ITS 17025
CALIBRATION 0059
CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	**LIQUID IN GLASS THERMOMETER**
MANUFACTURER	:	**N/A**
MODEL / TYPE	:	**0-100 °C**
SERIAL NO.	:	**N/A[SV-TL.020/2551]**
DATE OF CALIBRATION	:	**11 July 2022**

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C **Relative Humidity :** (55 ± 10) % RH

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-64** based on **ASTM E 77-07** as calibration guidelines.

The calibration was performed by comparison with Calibration Bath,Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.

2. Precision Thermometer, ASL Model F201 S/N. 016168/09 with IPRT S/N. L0193A-1-1,L1123A-1-5.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd. Certificate No. Q22007520, Due Date 22 January 2023.

2. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR) and National Institute of Metrology (Thailand). Certificate No. PSL-T 1094/64,TT-0121-21,TT-0107-21. Due Date 04 November 2022,24 November 2022,04 November 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2,00 which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2021)"

@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

The DUC Reading were recorded and the means value were reported of four times measurement in the table below.

CALIBRATION DATA

CORRECTION OF TEMPERATURE

STD Reading (^{o}C)	DUC Reading (^{o}C)	Correction (^{o}C)	Uncertainty $\pm$ (^{o}C)
*3.87	4.0	- 0.13	0.13
20.00	20.0	0.00	
24.97	25.0	- 0.03	

Range : 0 ^{o} C to 100 ^{o} C

Graduation : 1 ^{o}C

Immersion Type : Total Immersion.

Correction of Reference Temperature (0 ^{o}C) = -0.1 ^{o}C

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 28 of 111

This report is valid for the above stated instrument/s only.

End of Certificate

THAI HEART CALIBRATION CO., LTD.
112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax.: 0-2757-8507

CERTIFICATE OF CALIBRATION

Certificate No.: T1-0607020/22 **Page** 1 **of total** 3 **pages**

Customer ENVIRPRO CO., LTD.
168/28 Nakniwas Rd., Ladprao, Bangkok 10230

Equipment	Water Bath		
Manufacturer	Memmert	**Model**	WNB 22
Serial No.	L514.0438	**ID No.**	SV-TL.041/2557
Description	Resolution of UUC : 0.1 °C		

Environmental Conditions	Ambient Temperature:	25.9°C
	Relative Humidity:	47%
	Atmospheric Pressure:	-
Calibration Location	Analysis Laboratory 1	
Received Date	6 July 2022	
Calibration Date	6 July 2022	

Date of Issue 7 July 2022

Checked by _____ **Approved by** _____

Act as Technical Manager

Representative of Managing Director

(Dr. Ekachai Puttitwong)

( ) (Krisyosl K.) ( ) (Sakda Y.)
( ) (Patiphan K.) ( ) (Onnapa P.)
(✓) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

This calibration [illegible] with the prior written approval of the Thai [illegible]

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Reference Method:

- The calibration method used was CP-085 based on an ASTM E715-80 (Reapproved 2016).
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according tc the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY59002152/ MY60001197	10-0401003/22	Jan. 5, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results: (X) Without Adjustment

Reporting of Temperature Distribution

UUC Reading (°C)	Measured Temperature (°C) @ sensor No. (Sensor No. P5 is Ref.)					Uncertainty (± °C)
	P1	P2	P3	P4	P5	
85.0	84.25	84.30	84.14	84.17	84.43	0.10

Reporting of Chamber Performance

Setting Temperature (°C)	Uniformity (°C)	Stability (°C)
85.0	0.23	0.03

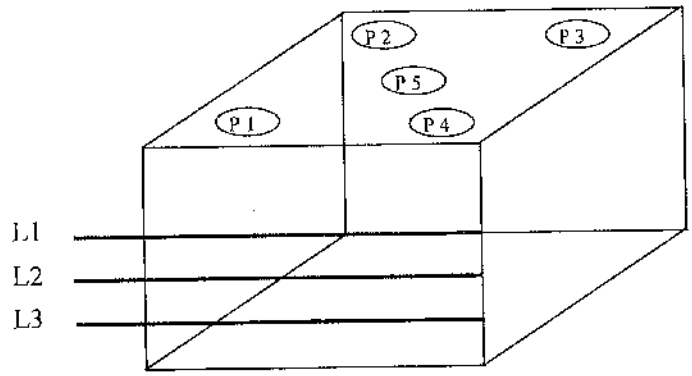
UUC: Unit Under Calibration

Apisit

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Measurement Results (Cont.):

Sensor Installation



L2 = 130 mm.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

Apisit

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CERTIFICATE OF CALIBRATION

Certificate No.: T1-0607019/22 **Page** 1 **of total** 4 **pages**

Customer ENVIRPRO CO., LTD.
168/28 Nakniwas Rd., Ladprao, Bangkok 10230

Equipment	Block Digestion Unit		
Manufacturer	VELP SCIENTIFICE	**Model**	DKL 12
Serial No.	465101	**ID No.**	SV-TL.084/2561
Description	Resolution of UUC : 1 °C		

Environmental Conditions	Ambient Temperature:	25.9 °C
	Relative Humidity:	47 %
	Atmospheric Pressure:	-
Calibration Location	Analysis Laboratory 1	
Received Date	6 July 2022	
Calibration Date	6 July 2022	

Date of Issue 7 July 2022

Checked by _____ **Approved by** _____

Act as Technical Manager — Representative of Managing Director

( ) (Krisyosl K.) ( ) (Sakda Y.) (Dr. Ekachai Puttitwong)
( ) (Patiphan K.) ( ) (Onnapa P.)
(✓) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

This calibration [illegible] with the prior written approval of the Thai Heart Calibration Co., Ltd.

THAI HEART CALIBRATION CO., LTD.
112/1 Moo 5, Pbraek Sa, Muang, Samut Prakan 10280
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507

Reference Method :

- The calibration method used was CP-142 based on an in-house method.
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY59002152/ US37245775	I0-0401002/22	Jan. 5, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- THC, Thai Heart Calibration Co., Ltd.

Measurement Results:

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	159.2	150	9.2	0.07	0.61
# 2	150	157.5	150	7.5	0.06	
# 3	150	157.0	150	7.0	0.07	
# 4	150	158.1	150	8.1	0.05	
# 5	150	158.6	150	8.6	0.05	
# 6	150	156.1	150	6.1	0.08	
# 7	150	156.7	150	6.7	0.04	
# 8	150	158.0	150	8.0	0.04	
# 9	150	158.1	150	8.1	0.06	
# 10	150	156.9	150	6.9	0.05	
# 11	150	157.3	150	7.3	0.06	
# 12	150	154.9	150	4.9	0.07	

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Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax.: 0-2757-8507

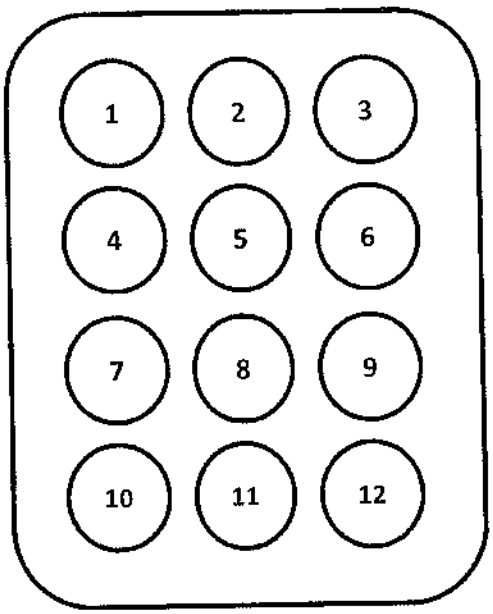
Measurement Results (Cont.):

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	380	387.4	380	7.4	0.26	0.61
# 2	380	386.2	380	6.2	0.17	
# 3	380	384.5	380	4.5	0.27	
# 4	380	386.2	380	6.2	0.24	
# 5	380	388.3	380	8.3	0.21	
# 6	380	383.3	380	3.3	0.32	
# 7	380	383.9	380	3.9	0.23	
# 8	380	387.8	380	7.8	0.23	
# 9	380	388.0	380	8.0	0.27	
# 10	380	385.3	380	5.3	0.29	
# 11	380	386.4	380	6.4	0.25	
# 12	380	380.7	380	0.7	0.24	

UUC : Unit Under Calibration

THAI HEART CALIBRATION CO., LTD.
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Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax.: 0-2757-8507

Measurement Results (Cont.):



Front View

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

PerkinElmer

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 200/400

Customer :	บริษัท เอ็นไวร์โปร จำกัด	Date Tested:	August 10, 2022
		Recommendation Recertification Period	6 Months
Address :	168/28, 168/30, 168/71 ถนนนาคนิวาส แขวงลาดพร้าว เขตลาดพร้าว กรุงเทพมหานคร	Recertification Due:	February 10, 2023
		Date Last Certified:	February 8, 2022
User Name:		Visit Number:	2 of 2
Phone:		PerkinElmer Phone:	02-719-6420 ext 206
Fax:		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
AAnalyst 400	201S5082209	AA WinLab32 Version 7.2
FIAS 100	100S3020504	

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
GFAAS Mix STD	N9300244	JUN 30, 2023
MG0-056	N101-3000	
MG2-054	N101-3002	

AA01801030

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 200/400

SERIAL NUMBER 201S5082209 **DATE TESTED** August 10, 2022

1. INSTRUMENT CHECKS

A. The mirror, prism and lenses condition. Clean if necessary.	OK
B. Inspect the grating.	OK
C. Inspect and clean or replace the dust filter.	OK
D. Clean the burner head, chamber and end cap.	OK
E. Clean the nebulizer.	OK
F. Check the condition of the end cap, chamber and nebulizer o-rings.	OK
G. Clean the drain system.	OK
H. Clean exterior the instrument.	OK

2. GAS SYSTEM CHECKS

A. Leak test all internal and extenal gas box joints	OK
B. Inspect the acetylene catridge filter. (Replacement catridge filter every 1 year)	OK
C. Inspect the air catridge filter. (Replacement catridge filter every 6 months)	OK

3. ELECTRICAL

A. Check incoming AC line voltage for proper levels and grounding.	OK
B. Check unit's software and firmware revisions and upgrade if necessary.	OK

4. FIAS CHECKS

A. Pump and 5 Port Valve	OK
B. Chemifold and Tubing	OK
C. Power Supply	OK
D. Flow meter and Gas system	OK

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 200/400

SERIAL NUMBER 201S5082209 **DATE TESTED** August 10, 2022

PARAMETER	SPECIFICATION	ACTUAL VAULE
5. PERFORMANCE TESTS		
*1. Detector-Linearity with Barium (553.55 nm).		
Neutral Density Filter 0.2 :	0.1806 Abs. ± 5%	0.1722 Abs.
Neutral Density Filter 1.0 :	1.0531 Abs. ± 5%	1.0158 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm). (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.010 Abs.	0.0021 Abs.
3. AA Baseline with Copper (Cu 324.75 nm). (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.001 Abs.	0.0004 Abs.
4. D_2 Background Compensation (Copper 324.75 nm). with Neutral Density Filter 1.0	Absorbance ≤ 0.010 Abs	-0.0022 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm). (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0004 Abs.
6. Flame Safety Interlock all Functions.		OK

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 200/400

SERIAL NUMBER 201S5082209		DATE TESTED August 10, 2022	
PARAMETER		**SPECIFICATION**	**ACTUAL VAULE**
7. Wavelength Accuracy with Nickel (232.00 nm).			
Nickel Prism Position		± 190 steps	21 Steps
Nickel Grating Position		+ 380, - 260 steps	32 Steps
3 mg/L Ni Standard Mean Abs		≥ 0.200 Abs	0.274 Abs.
8. Flame Sensitivity with Copper (324.75 nm).			
Cu Prism Position		± 120	12 Steps
Cu Grating Position		± 380	24 Steps
(2 mg/L Cu Standard at an integration time of 10 seconds and 10 replicates)			
	Mean Absorbance	≥ 0.250	0.348 Abs.
	Capacitance value	≥ 1.0 pF	1.5 pF

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 200/400

SERIAL NUMBER 201S5082209 **DATE TESTED** August 10, 2022

Remarks :

* - Neutral Density Filter refer to data sheet.

- Cu and Ni std replaced by N9300244 GFAAS Mix Standard

This is to certify that the above tests have been perfomed and the configuration tested

☑ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standrd terms and condition of sale, including warranty terms.

Service Department PerkinElmer Ltd.

Customer Service Engineer:

(Khwanchai Siangwong)

Customer Service Engineer

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Bangkapi, Huay Kwang, Bangkok 10310

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CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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NSC-TISI-TIS 17025
CALIBRATION 0059
CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	BURETTE
MANUFACTURER	:	WITEG
MODEL / TYPE	:	25 ml
SERIAL NO.	:	N/A[SV-TL.068/2559]
CLID. NO.	:	272201997
JOB CONTROL NO.	:	220625064270

CUSTOMER : ENVIRPRO CO., LTD.
168/28 NAKNIWAS RD., LADPRAO,
BANGKOK 10230 THAILAND

DATE OF RECEIVED : 25 June 2022

DATE OF ISSUED : 09 July 2022

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Prapaporn Khanchalee
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
09 July 2022

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q22064270

@ciccalibration

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CALIBRATION 0059
CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	**BURETTE**
MANUFACTURER	:	**WITEG**
MODEL / TYPE	:	**25 ml**
SERIAL NO.	:	**N/A[SV-TL.068/2559]**
DATE OF CALIBRATION	:	**29 June 2022**

ENVIRONMENT CONDITIONS :

Temperature : (20 ± 2.5) °C **Relative Humidity :** (50 ± 10) % RH

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-86** based on **ASTM E542-01** as calibration guidelines.

The calibration was performed by using Electronic Balance,Thermo-hygrograph,Barometer and Thermometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Barometer, Barigo S/N.001.
2. Electronic Balance, Sartorius Model CPA224S S/N.23908487.
3. Thermo-hygrograph, Isuzu Model 3-3126 S/N.30760420.
4. Thermometer, Brannan S/N. 1.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q22011065, Due Date 03 February 2023.
2. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q22020944, Due Date 03 March 2023.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q22007505, Due Date 26 January 2023.
4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q22017270, Due Date 21 February 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2021)"

@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

The calibration was performed by applied volume to the Device Under Calibration (DUC) . The actual volume readings from STD were reported in average of seven times measurements.

CALIBRATION DATA

CORRECTION OF VOLUME

DUC Test point (ml)	Actual volume (ml)	Correction (ml)	Uncertainty ± (ml)	Coverage factor k
*1	1.0044	+0.0044	0.0038	2,00
12.5	12.5224	+0.0224	0.0066	2,00
25	25.0472	+0.0472	0.0068	2,00

Type of glassware : ☐ to Contain ☑ to Deliver

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 77 of 111

* means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

This report is valid for the above stated instrument/s only.

End of Certificate